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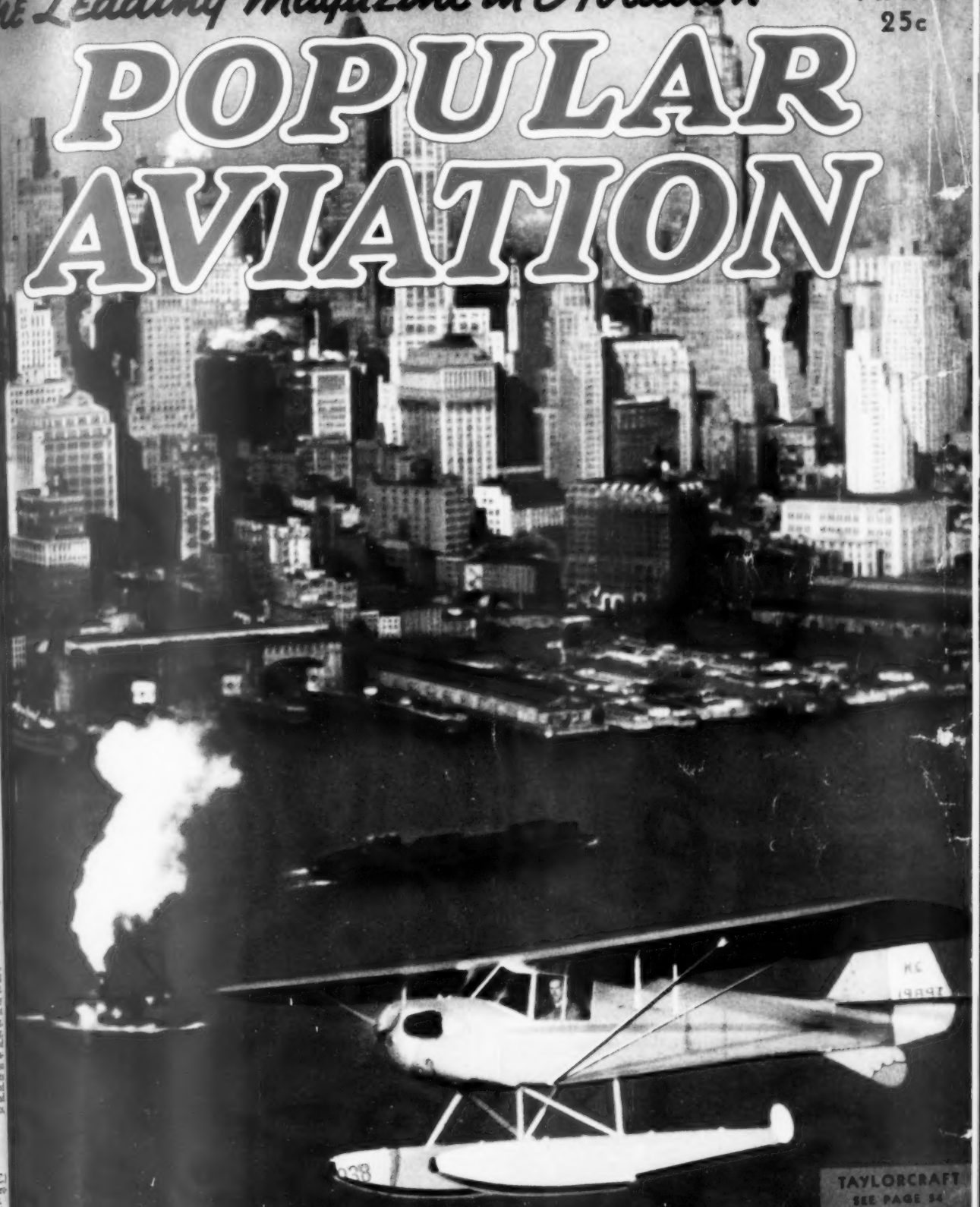

TAYLORCRAFT
SEE PAGE 84

THIS ISSUE

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[RADIO NEWS is not a new publication. The April issue, however, is the FIRST one under the banner of Ziff-Davis Publishing Company.]

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POPULAR AVIATION, Volume 22, April, 1938. Published monthly by Ziff-Davis Publishing Company, at 608 S. Dearborn St., Chicago, Ill., U. S. A. Subscription $2.50 per year, single copies 25 cents foreign postage $1.00 per year extra, except Canada. Entered as second class matter, January 24, 1933, at the Post Office, Chicago, Illinois, under the act of March 3, 1879.

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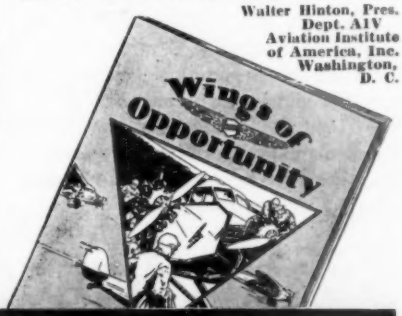

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(February 1937 — January 1938)

Months	Number Graduated	Number Placements	No. Co.'s Employing Graduates
1937			
Feb. . . .	4	13	7
Mar. . . .	33	21	11
Apr. . . .	8	16	6
May . . .	1	16	6
June . . .	34	14	8
July . . .	5	7	2
Aug. . . .	4	2	2
Sept. . . .	20	17	7
Oct. . . .	4	3	2
Nov. . . .	2	2	2
Dec. . . .	29	7	3
1938			
Jan. . . .	7	14	6
TOTAL .	151	132	27

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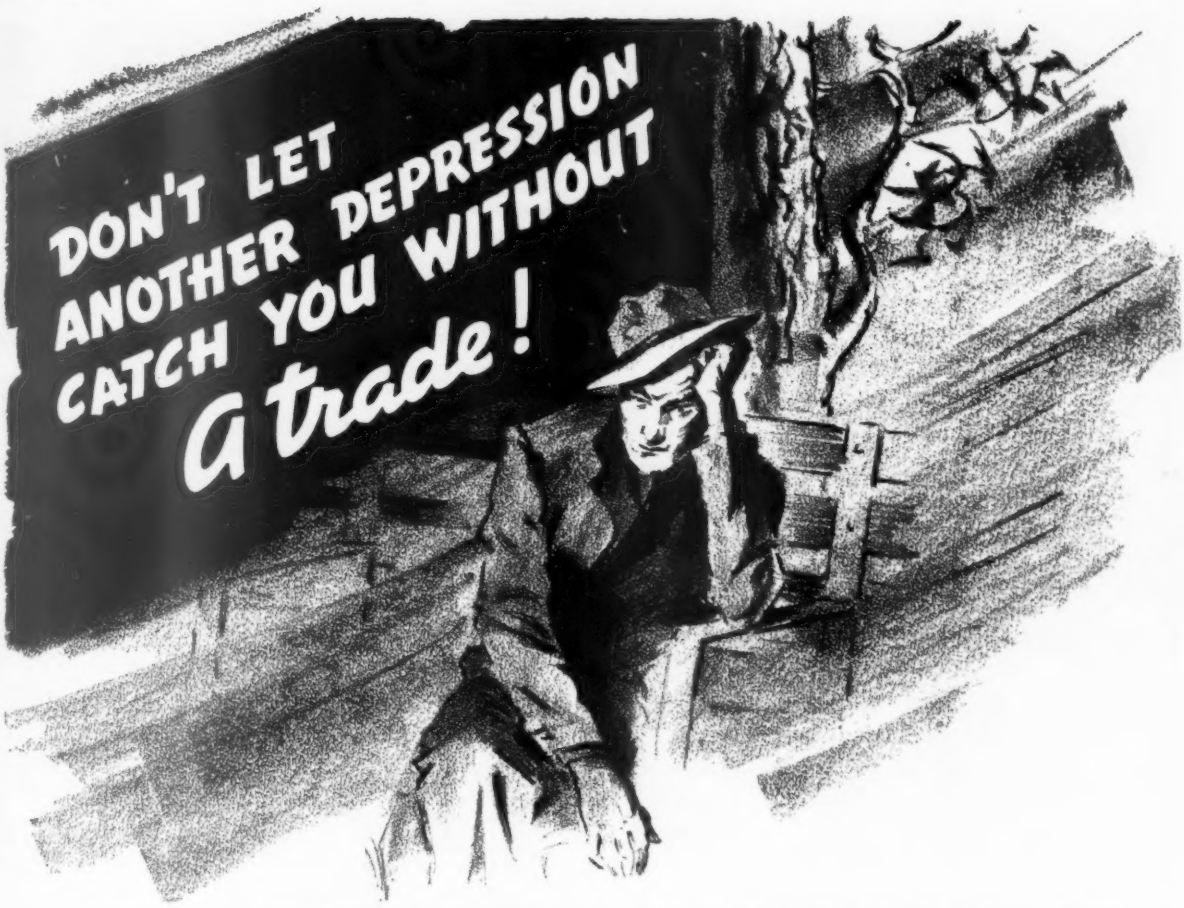

The last depression boldly emphasizes two facts of great importance to young men now planning their futures:

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Including SOUTHERN AVIATION and AERONAUTICS

Volume XXII APRIL, 1938 Number 4

FOR THE PROMOTION OF PRIVATE FLYING AND COMMERCIAL AVIATION

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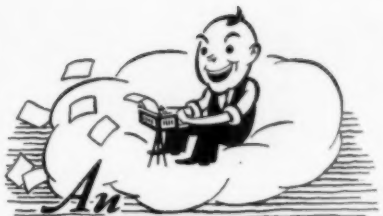


An Airy Chat with the Editor

WELL, now that the big Chicago Air Show is all over, nothing remains for us to do except nurse our aching dogs under the desk. And we'll proclaim, with everyone else who attended the exhibition, that "it was a great show."

I'll not take up much space in the Chat regarding the show, for that is described in detail further on in the book, but I will remark that the outstanding feature of the show, to my mind, was the intense interest it aroused among the general public. If they were not air-minded when they arrived they were certainly air-minded when they left. Thousands upon thousands of people got their first close-up of an airplane at such close range that they could actually feel it and gaze into its internal organs.

We'll even forgive that hectic floor-show, though we can't forget it.

* * *

AND this enthusiasm was sufficient to drag old John Q. Public out to the most inaccessable show place in the City of Chicago—'way out back of the yards where they park the bulls and cows. Had the show been located anywhere in civilized territory, it's a cinch that the attendance would have been at least doubled.

* * *

GETTING back to aviation from the stockyards, we wish to page those hardy amateurs who are still flying their identified ships. We'd like to get a word from them and also, if possible, word from those who were forceably obliged to discontinue. There should be some hot stories in some of these letters that the other fellows would like to read and profit from.

* * *

OUR FAMILY is growing fast. Last year, just about this time, saw the first appearance of POPULAR PHOTOGRAPHY, which, as you probably know, proved to be an outstanding success.

And now we announce another magazine in the group, the tried and true RADIO NEWS, recently purchased by the publishers of POPULAR AVIATION. But it will be a new and greatly improved RADIO NEWS that will greet you on the news stands, for we have created many new

(*Continued on page* 88)

Chicago had an Air Show

Photographers had a field day when, at the close of the show, exhibition models were flown out of the auto parking lot.

Well-planned exhibits in the arena drew large crowds. The airliner was most popular.

THE first of what is planned to be a series of annual aircraft shows was held at Chicago's International Amphitheater from January 28 to February 6. All things considered, the show was a success.

All things considered, that is. Considering the fact that several of the top-notch American manufacturers decided, with the usual cold aloofness, that they were a little too good and too busy to be bothered. The show purported (and was expected to) to represent America's aviation industry in its entirety. But the "money" companies were glaring in their absence.

For all-round public interest, the International Air Show was Chicago's outstanding aeronautical success. But so far as presenting this country's aviation industry to that public, the show was about a one-half success. It might be well to point out to the uninitiated, however, that the aviation industry in the United States is famed the world over for the ability of its members to get along with any and everybody's assistance. This, then, should explain—in part, at least—the absence of such representative American manufacturers as Boeing, Consolidated, North American, Martin, Curtiss-Wright, Grumman, Northrop,

(*Concluded on page* 81)

↑ Easiest to fly in and out of the show was the above Army Air Corps autogiro.

↓ The Army's Northrop A-17A was almost as popular as the Douglas airliner.

→ Chicago's air display included a teaser in the form of a "girl" show called the "Cavalcade of Flight." The "facts" and costumes (right) drew many a guffaw from aviation folk. One pilot wrote the show narrator a note telling the latter how to pronounce "aviation."

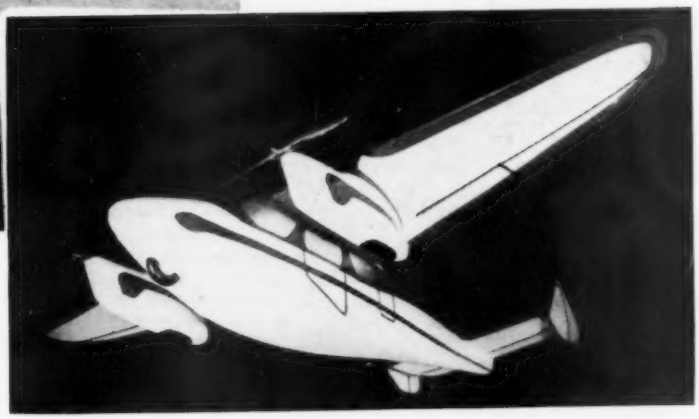
↑ Roscoe Turner thinks he signed 15,000 autographs.

This paint-covered nude was a sure eye-opener.

Gas models occupied one whole corner of the show's second floor. That of the C.G.M.P.S. (above) was representative.

Biggest air feature of the show was the parking lot this Stinson is flying out of. Dozens of ships arrived and departed.

Benny Howard's company was well represented by three ships and one model (below). The public was attracted by his deluxe float job (left) while the industry eyed the model of the Howard airliner soon to be built.

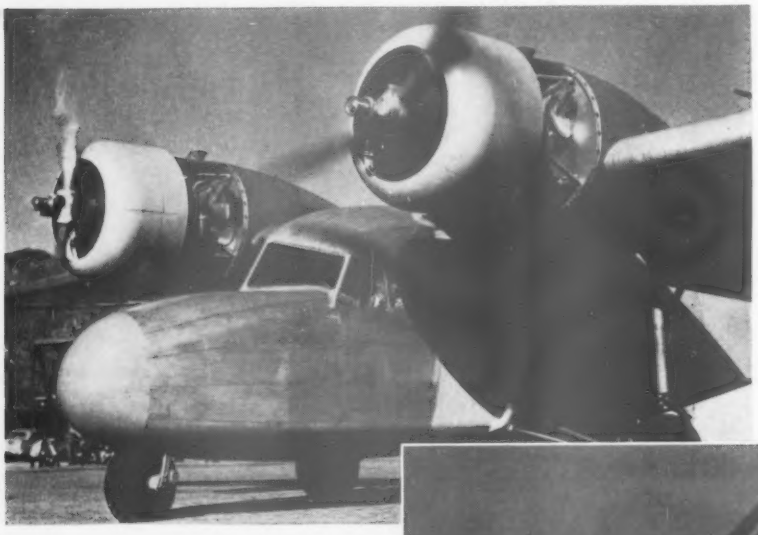


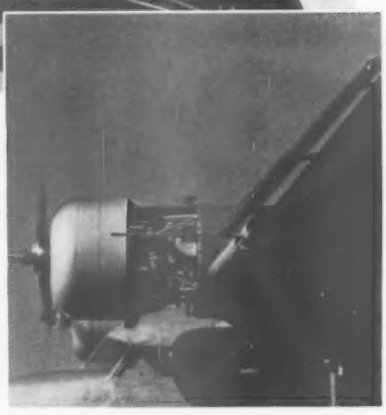
Lined up outside the Stock Yard Inn, exhibition ships got last minute checks before being flown from the parking lot.

Many thousands of show visitors visited POPULAR AVIATION'S busy booth.

Touchiest parking lot performance was that of the Lockheed "12". Both take-off and landing drew pleased gasps.

Another Three-Wheeler





The new Timm has steerable nose wheel (above) and Handley Page slots (right).

VISITORS at California's Grand Central air terminal one day recently saw an unusual but prophetic airplane take wings for the first time. That ungainly looking airplane was the twin-engined ship shown above and below; the Timm transport.

The new monoplane has the distinction of being the first completed "tricycle" transport. With Vance Breese, famed test pilot, at the controls the new Timm was put through its paces and, according to reports from POPULAR AVIATION'S correspondent, turned in a good performance for a first-timer.

In addition to boasting the safety assured by the three-wheeled landing gear, the Timm has an additional safety feature—slots. Special Handley Page wing slots are to be standard equipment on the new ship, according to its designer, Wally Timm. These slots operate automatically and eliminate serious stalls.

The Timm transport is a high wing semi-cantilever monoplane powered with two 425 h.p. engines. Though it has not yet received its A.T.C., the Timm is estimated to have a top speed of 200 m.p.h. and a range of 800 miles. Hydraulic brakes and the nose wheel have reduced landing run by 75 per cent.

Cross-wind landings can easily be made with the Timm transport. The ship is shown below coming in after a test flight. Pilot is able Vance Breese.

Lightning!

AIRCRAFT being struck by lightning continues to be a heated subject in more ways that one. A POPULAR AVIATION correspondent in Great Britain writes of a recent case of an Imperial Airways airliner being struck out over the English Channel while flying from Paris to London.

According to our writer, the airliner *Horatius* was out over the Channel about 40 miles when, while flying at 1,000 feet, the ship flew through a particularly dark cloud. According to information obtained from the airliner's Captain A. B. H. Youell, there was a sudden "heavy electrical discharge . . . accompanied by a loud explosion." Nothing happened inside the cabin and, shortly afterward, Captain Youell informed his passengers that a "discharge of static electricity from the plane into the dark cloud" had taken place.

Arriving over the English coast, the airliner was landed at the intermediate airport at Lympne. On the ground, a number of places on the wings bore traces of an electrical discharge and the radio aerial showed signs of having been heated.

Following the report of this unusual flight, experts, in discussing the incident with POPULAR AVIATION'S correspondent, advanced two theories. One gave as the possible cause for the incident a powerful electrical discharge set up by the friction of snow or hail which generates a very large static charge on the airplane's outer skin which, in turn, discharges itself at the first opportunity. This discharge may take place in a cloud, it was pointed out, or into the earth when the ship lands. There have been many reports of ground crew members experiencing a strong shock when touching airplanes that shortly before had flown through bad weather.

The second theory advanced was that the ship actually had been the conductor of a bolt of lightning as it passed through the cloud. Experts point out that this is possible, even with ships of wooden construction, because there always is just enough metal in the ship itself to allow the lightning to pass through.

There have been several unusual cases like this in Europe. One incident like that experienced by the *Horatius* occurred to a French airliner a few years ago while flying between Vienna and Budapest. Apparently, the French ship was struck by a powerful bolt. The ship dropped suddenly from 2,500 feet to 700 feet before recovering from the jolt. There was no fire and the ship continued her journey. Later, it was found that the flash had entered at the starboard navigation light. The lamp's metal was fused and, from the lamp, the charge had gone along the lighting leads into the radio apparatus and out through the ship's aerial.

END

Leading BANG-UP Lady

One would rarely suspect this devastating smashup to be the work of a pretty young girl like Jean De Luca.

by KURT RAND

Here is a girl that does well by way of smashing things. In fact, she's about the best lady liquidator around.

NO one would have thought 23 years ago that the chubby baby girl that had just been delivered to her proud parents at Birmingham, Alabama, would one day be known as "The Girl Without Nerves." Even when little Jean De Luca started to grow up and show tomboy tendencies, her parents little dreamt that their daughter would take to flying airplanes through barns and rolling speeding automobiles over on their backs. The tomboy traits, though, became evident as soon as the little girl began to sass back the neighborhood roughnecks. Her present-day nickname—Tommy—was the result of this.

Jean De Luca (or Tommy, if you prefer) has had more adventures and thrills in one day than any ten girls her age (or boys for that matter) have had during most of their lives. It's a little difficult to imagine a young blond, blue-eyed Italian girl sitting calmly behind the controls of a rickity airplane as it plows through a frame house as part of Capt. Frank F. Frakes' airplane and automobile "rodeo." One of the pictures on this page, however, was shot by a scared newspaper photographer who feared for the life of the little girl in the crashing airplane's cockpit.

Today, at 23, the quiet little Alabama lass is a veteran in the business of neck-risking for the thrill of it. After a varied "career" in her earlier days of adolescence, Jean De Luca wangled her way into Captain Frakes' airplane-auto stunt show after deciding that her job of punching a cash register in a local cafe was a mite too drab for one with her ideas.

When she first joined the Frakes stunt show, Jean immediately requested Frakes' permission to do a parachute jump. Though she had never had any previous experience with 'chutes, the mere idea of stepping out into space with nothing but a bit of silk between you and eternity appealed to her.

Captain Frakes, though, had other ideas about that. Despite the fact that that lanky Tennesseean is widely known for his "death-defying" feats with airplanes and automobiles, he is nonetheless a cautious, methodical planner. His various hair-raising stunts are not the "death-defiers" they appear from a county fair grandstand seat.

So he refused flatly, first because Jean was a girl and second because she lacked vitally important experience. Instead, he went to work training her to "stunt" automobiles and, later, to fly airplanes.

Jean De Luca's uniform runs at least a close second to Roscoe Turner's.

Gradually, after careful months of valuable experience, Jean De Luca was crashing automobiles as well as airplanes—and was doing well at it.

Now Jean has a voluminous scrapbook full of clippings from the various local newspapers that have heralded her prowess behind the wheel and joystick. Though she stunts more automobiles than she does airplanes, Jean's "specialty" is the crashing of old obsolete airplanes through buildings or into trees.

It is odd that a daring, popular young woman should shun social life as Jean De Luca does. Once in a while she likes to go to a dance or an occasional party, but the attentions showered on her by

admiring men have fallen (so far) on deaf ears. Literally, she lives for her work. Much of her mental energy is expended toward the devising of newer, more blood-chilling stunts to do in the air or on the ground. Though there isn't much that can be devised that hasn't already been done with airplanes, Jean's inventive streaks have been directed toward the automobiles she crashes—and most profitably.

One of her auto tricks is called the "Ski Jump." In this act (which almost always take place inside a fair grounds with an overflow audience in the grandstand) Jean drives her car at high speed onto a long wooden runway which is tilted so that the car roars along dizzily in front of the grandstand while cocked up precariously on two wheels. If she hits the runway at too steep an angle, well—even stunt people don't like to think of those things.

Another "afternoon's fun" takes place when Jean drives her car into the "Broad Jump." In this act, Jean drives at high speed up a runway and out into space over the roof of another car. With her flying car roaring through the air about 10 feet off the earth, it doesn't take much of an imagination to see what happens when the car lands.

But let's get back to aviation.

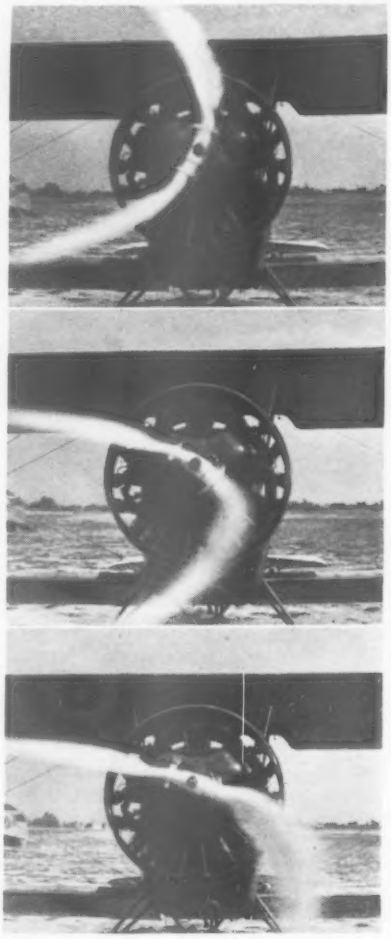
"I'm not a very good pilot," Jean told the POPULAR AVIATION correspondent. "All I can do is take them off and crash 'em."

Yes, that's all—and that's plenty. Once, while putting on a show at an Indianapolis fair, "the daring Captain Frakes" was to crash an airplane through an old condemned building. There wasn't a thing encouraging about this particular crash for the combination of a particularly "tough" building and a particularly time-worn airplane made the job on hand a little tougher than usual. The appointed time arrived and off to one side flew the wavering old airplane. Its drooping wings seemed to give it the appearance of deliberately flying to impending doom. Lower and lower the ship glided. Breathless fair-goers heard the engine die its last wheeze as the pilot throttled down for the crash. There was just the faint whistle of wind in the wires as the gliding ship sped toward the building's wall. There was a collective gasp as the huge crowd silently watched the ship's battered nose speed up to the wall. Then a splintering crash as the heavy engine plowed into the structure. The waving wings snapped back over the cockpit. The whole fuselage, pilot and all, disappeared into the sudden mass of flying, splintering wood. Suddenly there was a little puff of smoke, then a burst of flame. A few women in the grandstand screamed hysterically. The whole heap of wreckage was burning fiercely. It looked as though the pilot would be roasted alive.

Firemen raced to the scene. Close behind them whined the grim note of an ambulance. But there were more gasps when some violent motions were seen in the blazing wreckage. And firemen, showmen and spectators were horrified.

(*Concluded on page* 84)

Camera vs. Prop



Reading from top to bottom are Figs. 1, 2 and 3. The engine is an old J-5.

HERE is how the revolving airplane propeller is recorded through the focal plane shutter.

In No. 1 the propeller is revolving at 400 r.p.m. Since its length is eight and two-thirds feet, a little arithmetic shows that the tips are traveling 181 feet per second.

The action of the prop and the shutter explain the characteristic distortion. The prop is revolving counter-clockwise. The shutter travels from top to bottom, exposing the film from bottom to top. During the exposure the prop apparently revolved through an arc of about 90 degrees. Exposure 1/440 second with a Zeiss 4.5 lens, stop wide open.

In No. 2 the distortion is more pronounced because the prop r.p.m. is 1,000 instead of 400, the shutter speed still being 1/440. The upper blade shows less distortion because it chanced to be caught when parallel to the ⅛ inch opening of the shutter.

In No. 3 the prop speed is still 1,000, but the shutter speed is increased to 1/1000 second.

Army Needs Cadets

FACED with a serious shortage of Army flying cadets to fill the greatly increased class expected to enter the Army Air Corps training center, Randolph Field, Tex., plans to speed up appointments to the "West Point of the Air" were announced recently by Air Corps officials.

No written examinations will be held for the Spring class, which has been expanded from the usual 150 to 344 students. Instead, only candidates with at least half the number of college credits required for a degree are to be considered.

For years deluged by four or five times the number of applications possible to accept, the Army Air Corps today stands in immediate need of 200 more qualified candidates to complete the quota for the March class at the Air Corps training center.

Young men between 21 and 26 years who can pass the rigid physical examination and have had two or more years of college work are eligible. Flying cadets are paid $75 a month. The government provides in addition attractive uniforms, excellent food, and comfortable living quarters.

During their one-year course at the "West Point of the Air," flying cadets are taught under ideal conditions by expert U. S. Army personnel. Besides about 323 hours in the air, instruction is given in airplane engines, machine guns, navigation, and other academic subjects necessary to the military pilot.

END

Fish Story

IMPERIAL AIRWAYS tops this month's list of "human interest" yarns with the story (it's true, they insist) about the woman passenger aboard that line's four-engined Empire boat, *Cassiopia*, who went fishing while that airliner was being refueled at anchor in the Nile river.

Seems this unidentified lady spotted a curious fish swimming about the airliner's hull and, having nothing else to do at the time, got some bread from the steward, went to the ship's cabin door and coaxed the fish alongside. At first she had to toss little bits of bread to the cautious swimmer, but with a little more coaxing the fish came alongside and ate several pieces of bread out of her hand. POPULAR AVIATION'S Imperial Airways spokesman insist that not only the rest of the passengers but the *Cassiopia's* commander vouched for this story.

But that's not all. A little later, we're told, the same lady got together a piece of string and a pin and went fishing out the airliner's door. Those same witnesses also vouch for the fact that she landed "several large fish" in about ten minutes.

(Leave it to the British) . . .

END

This is a typical gathering of air people. The novel eatery already is one of Los Angeles' top spots.

"Ham And" Burgess

No one can be quite so hungry as a hungry airman. Wise Mr. Burgess went ahead from there.

"HAM & EGGS, Incorporated."

An idea, an aviation background dating back to the start of air transport, and a host of friends have put H. A. Burgess, long-time close associate of the late Harris M. "Pop" Hanshue, into a prosperous restaurant business in Los Angeles.

Opening up for business early in December on swanky Wilshire Boulevard, Ham & Eggs, Incorporated is packing the customers in and already has become the unofficial rendezvous for aviation officials in town and visitors to the west coast.

Open 24 hours a day, "Ham & Eggs" features imported Westphalian hams, as well as the choicest Virginia and other domestic products, Irish and Canadian bacons, coffee-blossom honey, all variations of hot cakes and waffles, coffee that wholesales for 35 cents per pound. Special serving trays moulded to fit specially moulded fry pans, an all-electric kitchen and other novelties are featured in Burgess' novel establishment, whose fixtures, decorations and appointments have been supplied by Barker Bros.

Financed exclusively by stockholders drawn from the ranks of aviation, the "Ham & Eggs" backer list reads like a who's-who of the industry, including airline presidents, manufacturing executives, pilots and other operating personnel, traffic men and clerical help, down to airport porters.

A partial list of stockholders includes such names as Charles H. Babb, Arthur G. Beggs, Kenneth J. Boedecker, Warren Carey, George T. Cussen, C. W. Dayhoff, C. A. Elliott, C. W. France, C. N. "Jimmy" James, C. F. Lienesch, Paul Mantz, S. A. Morehouse, Palmer Nicholls, E. P. Querl, Commander C. E. Rosendahl, Paul E. Richter, Carl B. Squier, Allan A. Barrie, Wm. B. Birren, Don Black, Jeanne Boynton, Frank E. Bradley, H. A. Burgess, Ray F. Chesley, Leonard Comegys, L. H. Dwerlkotte, Gilbert L. Giveen, Samuel E. Gates, G. Edgar Lovejoy, Wm. Maxfield, Clifford Mutchler, Albert E. Roeck, Walter G. Ryberg, G. R. Tremolado and S. W. Voorhees.

Let the aviation industry try and keep this grub palace to itself, though, and you'll have dissention—at least in Los Angeles. The public has taken to the place with a vengeance. So, also, has Hollywood. Humphrey Bogart and Myrna Loy are two who have been there.

But people or no people, it's the food that is emphasized at Ham and Eggs, Inc.—and how it is emphasized! Everything served is a breakfast dish: small steaks, prize sausages, waffles, hotcakes, buckwheats and (of all things) pancake-egg sandwiches. There are potatoes in several styles and Burgess' "hangtown fry" which must be sampled, not described. With the aviation making proverbial beelines for the place, Mr. Burgess is safe in saying that he has done that peculiar industry a good turn.

This hungry pilot is popular Si Morehouse, TWAirman, as well as stockholder.

Carl Squier, Lockheed official, is one to appreciate good ham and eggs.

ONE MAN

by ALMA HEFLIN

You haven't seen many Cubs that Kenny Kress has not flown. He's some lad, as you'll soon agree. Read on.

EIGHTY-FOUR putt-putting lightplanes floated southward from all sections of the country early last December and obediently followed each other down to the runways of Miami's airport. A few days later, with the annual air races at Miami over, all 84 *Cubs* followed each other down the Miami airport runway and dipped wings in salute as the putt-putting squadron disbanded. All told, that *"Cub* Convoy", as it was known, flew an aggregate of 163,000 miles without a single accident.

Now that's a newsworthy enought item in itself, if you're willing to let it go at that. But if you wanted to dig a little further into that mass flight of lightplanes, you would probably have found the story we record here.

It concerns one pilot.

He was one of those 84 pilots. But he was the only pilot who actually had flown every one of those 84 ships at some time or other—as well as the hundreds of other *Cubs* that are flying in all corners of the earth today.

Meet, in other words, Kenny Kress.

Kenny Kress is the kind of a test pilot Hollywood doesn't make movies about. There isn't much along the spectacular line in the test-hopping of a *Cub*. The average person thinks of a test pilot in terms of a devil-may-care young blood who takes great delight in power-diving an Army or Navy fighter until the instruments chalk up 450 m.p.h. Then he's supposed to yank the screaming warplane out of that dive until another gauge reads something like 6,212 G's. Anyhow, all test pilots aren't like that—and we have Kenny Kress to prove it.

Those 84 *Cubs* were simply a few short days' work for Kenny. Since April, 1936, he has actually test-hopped 1,200 *Cubs*—all that have been turned out by the Piper Aircraft Company during that time. There is little doubt, then, that the sturdy Mr. Kress has tested more airplanes than all the other test pilots put together—including Hollywood's.

Lock Haven, Pennsylvania, is rapidly getting used to Kenny. Since the Piper company moved there a few months ago, the whole Lock Haven sky has been filled with Kress. Literally, that is. After all, when you get one test pilot averaging five to six airplanes per day, the sky is bound to be pretty busy. The weather would have to be pretty close to the ground in Lock Haven not to have a *Cub* snapping and flashing through loops, barrel-rolls, spins, dives, wing-overs, spirals, slips and chandelles. And no sooner does that one ship's wheels touch the runway again, than there is another *Cub* scooting down the

↑ Off the production line come more Cubs, complete to everything but the Kress okay. These are just a morning's work.

← In a few days these fuselages will be whole airplanes and Kenny Kress will be giving them their most conclusive test.

AIR FORCE

Ship after ship is rolled off the production line, gassed up, started and turned over to Kress (foreground). A gruelling aerial workout climaxes the job.

Lock Haven field to go through the same maneuvers again. Each time, Kenny Kress is behind the controls.

These days are seeing more and more "local boys who made good." Lock Haven—in this case, at least—has its own flying example. Kenny Kress is a native Lock Havenite. It wasn't so long ago that the mere suggestion that he would hold the job he now does would have had the Kress family alternately giggling and gasping. Until he was 15 years old, there wasn't an airplane closer than Williamsport, 30 miles away. Lock Haven didn't even have a small airport. Williamsport might have had possibilities—except that the Kress budget (or any budget) couldn't exactly stand up under the shock of $25 to $30 per hour for flight instruction. Nevertheless, Master Kress was determined to get his fill of aviation.

Kenny got his first aeronautical "break" in 1928. A fellow by the name of Frank Gibson had the audacity to bring an OX-5 Travel Air to Lock Haven. It was a red-letter day when he first landed that ship on that weedy piece of ground near the bend in the Susquehanna river. Kenny became that familiar sight around any small airport: the young fellow who wipes off the airplanes, helps the mechanics, fills the gas tanks and cuts the grass—all in return for a little flight instruction. Anyhow, that's the way Piper Aircraft's able young test pilot got his start. Kenny would spend his nights—after leaving the "airport"—studying books on flying, engineering, radio and mechanics.

Kenny's birthday and the Bald Eagle Airways arrived at about the same time. Bald Eagle had opened a branch at Williamsport and saw fit to hire the now-experienced 17-year-old Kress lad as a pilot. His experiences while flying for that company were varied, but Kenny apparently didn't think much of being a semi-semi-airline pilot. So when his chance came with the Piper Company (then the Taylor Aircraft Company), Kenny grabbed it.

That was in 1936. He was 19 years old at the time and had a log book full of 1,500 hours. Today, he looks back on that beginning with a humorous smile that is tempered with a certain amount of reverence. . . .

Lightplanes—any of them—are far from being the toy some pilots make them out. They are full-fledged airplanes and are treated as such. Hence, the testing of a recently completed lightplane is not child's play; it's an important job that the Bureau of Air Commerce would never think of leaving undone. As stated before, however, the testing of new aircraft does not always mean "tear-'em-apart" power dives and everything that goes with them. The *Cub* is just the other extreme.

Just in case you didn't already know, the *Cub* is powered with a 40 h.p. Continental engine. The ship is a high-wing semi-cabin monoplane that costs about as much as a medium-priced automobile. The average lightplane owner gets about 25 miles of flying per gallon of gasoline.

Kenny test-hopped an average of five *Cubs* per day last year! His minimum per day has been two; the maximum, six. But every *Cub* that leaves the factory must be flown and okayed by him, which accounts for the fact that Kenny now has more than 2,000 hours of logged time on *Cubs* alone!

Kenny's job largely involves the routine testing of each *Cub* as it comes off the production line. When a ship is ready, he pulls on his parachute, straps his note pad to his knee, climbs in and flies up over Lock Haven.

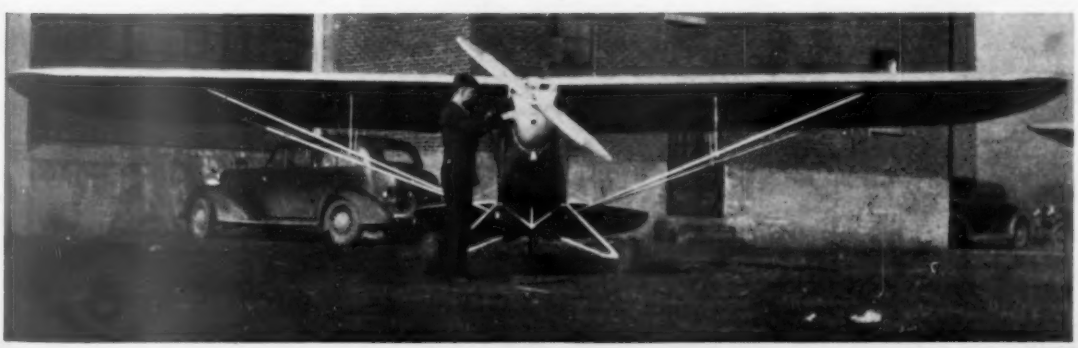
At 3,000 feet, Kenny levels the new ship off and pushes and pulls her controls around thoroughly, searching for any slips. He always climbs to that altiture "just in case." But he's never had to use his 'chute yet.

The ship's stability is one of the important factors to be checked. Kenny puts the ship into various positions in the air, releases the controls and watches what happens. Each motion is noted carefully on that knee-pad. Then stalls. Spins are perhaps the most important thing to be checked. Each *Cub* must recover from a spin *hands-off*. They must also recover from stalls and slips the same way.

Diving and pull-out tests follow. First, Kenny puts the ship into a shallow dive, takes his hands off the controls and awaits the *Cub's* reaction. It is supposed to level off of its own accord. Then into steep power dives and sharp pull-outs; spins, rolls, loops. Not like an Army fighter, mind you, but the *Cubs'* little engines turn up enough of a row to give Lock Haven something to listen to of a dull afternoon. Everything must go off just right or the ship goes back into the factory for checking. Then back again to do the whole thing all over again.

When coming in for a landing, Kenny

Quite a few Cubs are exported. That below is earmarked for New Zealand. In meeting special requirements of various governments, both Kress and a Bureau of Air Commerce man test the ship.



tests the *Cub* for its characteristics close to the ground. Rough landings like those of a one-hour student are tried. The ship is mushed into the ground. Then back into the air for a half-hour hands-off ride around the landscape—"just to be sure." When it's all over and the ship has passed, Kenny signs his okay on the ship's log and climbs into the next waiting *Cub* to do it all over again.

It's not as drab as all that, however. Kenny had one little adventure with a Canadian *Cub* that had just been put through its paces by Army test pilots at Langley Field. Incidentally, the Army boys dived that ship to a 6G pull-out! Anyhow, Kenny was interested enough in that performance that he wanted to try it himself. The Canadian *Cubs,* by the way, must have doors on both sides, instead of just one, like the American models. That's a Canadian regulation.

Kenny climbed her high, then stuck the nose down and let her have it. Wires screaming and motor pounding, the *Cub* streaked for the earth. Kenny was watching the instruments and jotting on his knee-pad when there was a sudden explosion behind him. Quickly, he snapped the throttle shut, cut the switch and got ready to bail out. But, looking out, he saw that both wings still were intact. Curious, he squirmed around in his seat to find that one of the ship's isinglass doors had been jerked off by the terrific suction set up by the dive. That was the closest Kenny ever came to joining the Caterpillar Club.

When Kenny "hasn't anything else to do" at the Piper plant, he serves as the instructor of the *Cub Flyers,* the Piper employees' own flying club. To date, he has instructed and soloed about 150 students as his part of this work.

For a full-fledged airplane pilot Kenny Kress is unusual. In the first place, he is firmly convinced that the lightplane is safer for general use than the heavier airplanes.

"I base this theory on two factors," Kenny said recently. "First, a lightplane can be slowed down to speeds that would be below the stalling speeds of larger ships. This is particularly advantageous in soupy weather. If weather suddenly closes in on a lightplane pilot, he actually can fly 'low and slow' with perfect safety. He can nose his way along a railroad or highway until he can find a place to sit down. You can't do things like that in big ships.

"That ties right in with my second factor—a lightplane's high gliding ratio and resultantly small landing area required. After all, a ship with a 10-to-1 gliding angle has two strikes on the big ships right there. Believe me, when you're caught by some of that sudden mid-winter zero-zero, you want an airplane that will get you down safely under any condition."

You don't find many experienced airmen saying things like that. But Kenny knows what he's talking about—from actual experience. He also is a firm believer in the theory that the penniless air-minded enthusiast still can learn to fly. Kenny speaks on that score from actual experience also.

"I got my basic experience in aviation by going out and trading work for flying and mechanical experience and burned the midnight oil for technical training out of my books. It's harder now, though, because there is more competition, but if a fellow goes out to a field alone and shows he's willing to work hard, he'll be surprised to find the number of jobs waiting for him. Books are hard to plow through sometimes at the end of the day, but if he's trying hard there's usually someone at the field who can help him over the worst spots.

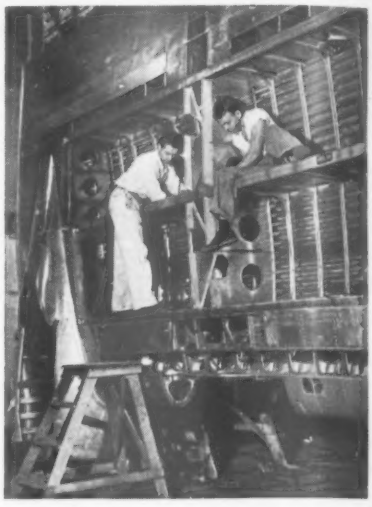
"However, if the fellow is headed for airline work, he has to have broader and deeper experience. In that case, his best bet is to get a job with an aircraft factory. Practical training in the day, cheap flying time with the employees' club—if there is one—and work at night, will help him get into the experimental department where he can put his ideas to work. In the meantime, he can be saving money toward an advanced flying course, radio work and blind flying at some recognized school."

"But he will have to be as patient as the proverbial wooden Indian, for 'getting there' is one of the toughest grinds I know of. A great many fellows give up too soon; there's no reason why many of them couldn't have been flying for a living today."

With those words Kenny zipped up his leather jacket, grinned and set out to test another trio of *Cubs* before dinner. . . .

END

Inside a Wing



The men are working on a DC-3 wing.

FOR the edification of POPULAR AVIATION readers who have not yet seen the inside of the wing of a modern airliner, we offer the above view of a Douglas DC-3 wing under construction. This wing, however, will only be an ordinary one—compared to those now being built for the giant new Douglas DC-4 "tricycle" transport.

Uncle Sam Buys Towers

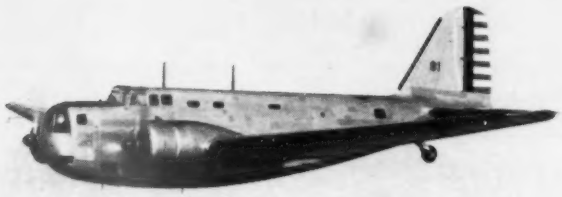
THE United States Department of Commerce has awarded a $350,000 contract for the fabrication of 400 radio-range towers to be erected at various points throughout the country.

The erection of these new towers at needed points, and the modernization of present stations represents a progressive step toward improving air safety by the government. Radio-range towers provide airplane pilots, by means of radio signals, with a dependable and constant guide to their destination. The signals, leading the pilot from station to station, are the invisible highways of the air.

Modern radio-range stations consist of a group of five towers, four of which form a square with the fifth tower in the center. The towers are about 135 feet high, and the radio impulses go out directly from the tower structure. The four outside towers transmit what is known as the beam course, while the center tower is used to transmit weather reports and other information without interruption of the beam signals. This simultaneous broadcasting is a recent achievement of radio engineering by the Bureau of Air Commerce and has been hailed by aviators as an outstanding contribution to air safety.

Of the towers, to be erected about half of them will be used to modernize or relocate existing stations and 44 new five tower stations will be built at needed spots.

END



COMBAT AVIATION RADIO

Here is Army Air Corps radio by a man who knows it. This subject is extremely important to modern military flying, though it is little publicized.

by WILLIAM A. LENTZ, JR.

HOW many of you old wartime gunners and observers who crossed the front lines in DH's, Salmsons and Breguets for a look-see on artillery reconnaissance remember the old blooper-dyne radio sets the government furnished to contact our artillery positions? Plenty, I'll bet. And remember the miles of trailing antenna you reeled in before coming in for a landing or to use your rear gun to hold off a Boche pursuit ship till you arrived safe and sound behind your own lines? Those were the days when you didn't know whether your transmitter would work or not, but hoped it did. You had a receiver that picked up so much engine noise that you couldn't tell whether the ground station was calling you or it was just one or two spark plugs that wanted to start up a little ragtime tempo, but sounded so much like a Spandau machine gun that you looked up with a jerk to see who was on your tail.

Those were the days, all right, but they are gone forever. Now you have a regular radio operator who sits in a swivel chair with a desk all his own and a roof over his head, and if he gets a little chilly just turn on the heat and everything will be shipshape.

We have in our Army Air Corps many different types of ships to perform many types of missions: bombardment, reconnaissance, pursuit, attack, observation, training and cargo. Each one of those mentioned rely on radio to function 100 per cent so that there will be less chance for a failure to perform a mission assigned that ship and also to strike a quicker blow at the enemy. The pilot of a bomber has his own transmitter and receiver so that instead of wasting a lot of precious time waggling wings and doing shallow dives to attract the flight's attention to a certain maneuver, all the flight leader has to do is pick up his microphone, press the button, call the ships by number, tell them what to do, then listen for an okay from each pilot, all in a few seconds' time.

Of course the larger ships carry two complete sets; one for the pilot and one for the radio operator who is in constant communication with his air base ground station. It is the radio operator's duty to send and receive position reports and numerous other important messages which the pilot and navigator rely upon. In the reconnaissance flight the radio operator is one of the most important members of the crew of a reconnaissance plane; it's up to him to send and receive position reports of his ship and of the target and to intercept any messages he hears for one of them might be a message containing the change of course of the enemy. In the bombing planes it's up to the radio operator to intercept and receive messages of value from the other ships so that there will be absolute co-operation from the whole flight.

When a military airplane goes on a cross-country mission the pilot's best friend is his radio. With it he flies the beam and receives regular weather reports. To do this and fly combat missions, his radio has to be in perfect condition. Aviation radio today is almost perfect: proper bonding and shielding to get away from engine noise and static charges in the metal of the ship; antenna systems that function perfectly with the minimum amount of space so that his transmitter will radiate its rated output and not interfere with the reception of his receiver, and also not create too much drag in the slip stream of the ship.

Static is still the Waterloo of the modern aircraft receiver, even with all the modern doodads like automatic volume control, more sensitive tubes, and a host of other aids. The engineers still have not conquered static, whether it be in combat aviation or commercial. Anyone who has listened in on a receiver while flying through any kind of a storm knows just what kind of a racket static can make. Imagine a pilot flying for hours at a time, trying to pick up a beam or get a weather report while listening to a model thunderstorm, a young war, and tin pan alley at the same time.

To get back to combat aviation radio, suppose we make an imaginary flight in a B-17 (called *Flying Fortress* by the laymen. The flight is scheduled for eight in the morning; at 7:30 the radio operator assigned to the ship climbs aboard. The first thing he does is to check the ship's interphone, which is a series of small metal boxes containing a headset jack and a microphone jack and on top of the box is a control switch which is used to control the interphone at that position. The interphone is the ship's telephone system with a control box at every strategic position and place in the ship. After checking the interphone, he then checks the ship's command set, which is the pilot's transmitter and receiver. He checks the transmitter for output, modulation and frequency, then calls the airport control tower for a further check. After receiving an okay (which is a way to check the reception of the command receiver)

This is a typical Army ground station.

the reception of the command receiver) he then tests his liaison transmitter for output, modulation, tone telegraph, and CW telegraph or continuous wave. All this is done on a fixed antenna which runs from wing to wing. The operator usually checks in with his group or squadron ground station.

After all these preliminaries he initials the daily flight report, which means the ship's radio equipment is okay.

It is now time for the flight. The pilot, co-pilot, navigator and bombardier get aboard, the engines are run up and all controls tested. Soon everything is ready and we taxi out for the take-off. The co-pilot picks up his microphone (that has a push-to-talk button on it) and calls the control tower for permission to taxi out on the field for the take-off. The pilot then taxies out on the field, stops and runs up his engines again for another check while the co-pilot calls the control tower again for permission to take-off, stating whether it is a local or cross-country mission. The control tower then gives them the okay surface wind direction and speed and we are off.

After the ship climbs to its cruising altitude, the radio operator lets his trailing antenna out. We are on a high frequency which means we only have to let out about 30 or 40 feet of wire, depending on the particular frequency we are going to use. The higher the frequency, the less wire we have to let out.

We now have our transmitter tuned up to our antenna and the operator gives the ground station a call and checks into the radio net. After getting the okay from the ground station, the operator turns his transmitter off and listens in on his receiver for any incoming signals.

Meanwhile, the pilot or the co-pilot switches from low to high frequency and is able to talk to any ship of his flight. The same operation is repeated when coming in for a landing and the radio operator checks out of the radio net and reels in his antenna. This only takes a few seconds with the modern antenna reels now in use by the Air Corps.

Indeed, combat aviation radio has progressed rapidly in the last 19 years. Records are being broken almost daily for distance on the liaison set. On the command set, it used to be that you were lucky to contact a station 25 miles away on voice. Recently, though, while coming in from the west coast, my co-pilot contacted a field over 100 miles away, and that was on the regular Department of Commerce frequency of 3105 k.c. with a 25-watt transmitter (take notice you pilots with two-way radio in your ships. My liaison set, meanwhile, reached back to the field we had recently left (over 450 miles with voice on 3105 k.c.), so the days of yelling your lungs out to a station 20 miles away—thinking he can hear you better—is a thing of the past.

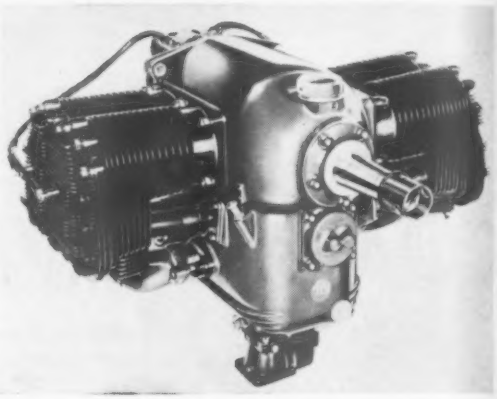
END

Features of the Menasco M-50 Engine

THE Menasco Manufacturing Company, builders of the Menasco in-line air-cooled aircraft engines, has entered the low horsepower engine field with a 50 h.p. four-cylinder, horizontally opposed L head air-cooled aircraft engine.

Displacement is 144.4 cubic inches with a bore and stroke of 3½x3¾. The engine develops 50 h.p. at sea level at 2550 r.p.m.'s. and weighs less than 160 pounds or approximately 3.2 pounds per horsepower.

The new engine, which has been in development for more than a year is to be known as the Menasco M-50. Production will begin immediately.



Menasco enters the lightplane field with this four-cylinder opposed type Model M-50.

Features of the Menasco M-50, the first of which has just completed exhaustive tests at the company's plant, include increased cooling as a result of more total fin area, enclosed valve mechanism and a square section manifold. The latter feature will give a more efficient distribution of fuel to the cylinders.

A wet sump with a geared type oil pump is utilized with the crankcase finned for increased oil cooling. Oil capacity is four quarts. A Stromberg up-draught carburetor with altitude control and a single magneto are other features of the new engine.

The crankshaft is of the one piece, three throw type with two main bearings. Cylinder blocks are of nickel cast iron with aluminum alloy cylinder heads bolted on the cylinder blocks. Overall width is 27⅞ inches. Compression ratio is 5.5 to 1.

Night Life on a Sleeper Plane

THE bulge in the curtain of upper berth B, Chicago to New York sleeper plane, meant that the man from San Francisco was retiring at 8:30 p.m. for a good night's rest.

It was one of the first through trips of the United Airlines' sleeper planes to the east coast. Previously sleepers have only been in use in the west. The novelty of the quiet, curtained vestibule was still great enough to make everyone stare with fascination as the toes of the shoes disappeared within the berth. Presently another man followed suit and retired.

The rest of the 12 passengers crowded into an unmade compartment or into the ladies' or men's lounges at the end of the plane. A sign, as in a train, warned everyone to observe quiet "so as not to disturb the sleepers."

From the rear of the plane came the cheerful clink of dishes as Stewardess Irene Guest prepared the "sleeping potion" for weary passengers—rich nourishing hot chocolate in big cups with crackers.

She had already jotted down on her schedule sheet the time that the two sleeping passengers wanted to be called. One had put in a call for 2 a.m. when the plane would land in Newark. The other was going to sleep through till 8 a.m. in the hangar at Newark. For a great feature of this sleeper service is that, upon arrival in the wee small hours, at the eastern terminal, the ship taxies silently into the hangar where the tail is jockeyed up so that passengers sleeping will not slide down hill, and they are allowed to rest quietly through till morning.

The movement in the upper berth curtains gradually subsided and the New York eye doctor who had been attending a convention in Chicago and a New York World's Fair promotion man started swapping stories. Only these were all sleeper plane stories instead of sleeping car stories. Stewardess Guest chimed in and related how, just as the plane was coming in for a landing out west one day last week, a man getting off at the next stop, arose from his berth and couldn't find his pants.

And of how the stewardess and all the passengers put on a frantic search for them, said pants finally being discovered way beneath the next berth where someone had accidentally kicked them.

About this time the good night drinks were served. A man who was making his first trip by air confessed he wasn't going to retire at all. He was afraid he'd miss something. He chatted with the head of a well known transcontinetal bus company, who for some reason, had scorned buses and was taking to the air.

A Californian who had been unable to get a sleeper till he arrived at Chicago, decided to stretch out after all, and began to climb into his lower berth.

(*Concluded on page* 94)

NAVY WATCHMEN

Three observation ships from Chicago's Naval air base hold a tight formation for the cameraman.

California's Grand Central Air Terminal now has free stenographic service for the aerial businessman. Salesman-Pilot Charles Jones gives Frances Morello some notes.

Ten new Mexican airplanes recently were flown from Hartford to Mexico led by Lieut.-Col. Rafael Montero (left). Lieut.-Col. Riccardo Calderon saw them off.

Personalities

Le Roy Grumman (left) and Test Pilot Lee Gehlbach are famed but seldom seen. Above appearance was with a new Navy fighter.

Singer Donald Novis and Dorothy Bradshaw recently flew to Arizona where they were married.

Comtesse Juanita Desbriere, member of a European royal family, now is living in Florida where she has taken up aviation. Flying typical American lightplanes is to her the most thrilling of sports.

These three aeronautical figures got together at the recent National Aeronautics Planning convention to discuss aviation. Left to right are Col. J. Carroll Cone of Pan Am, Richard DuPont of soaring fame, and Glenn L. Martin.

W. A. Harriman, prominent railroad official, recently flew to Washington to confer on improving rail business.

Hearing that his wife had borne a son, Pilot J. B. Franklin set a new airline mark between Buffalo and Washington.

Ger Wood, famed boat racer, is back in the air again with a Grumman G-21.

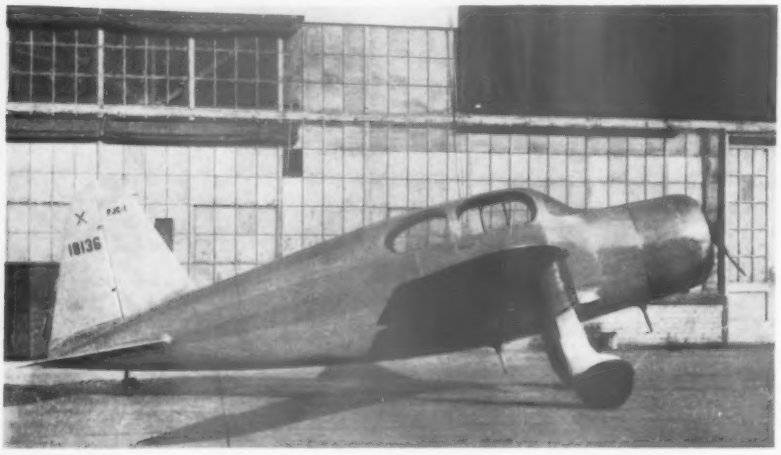
Millionaire-Pilot Howard Hughes will not fly his new amphibian around the world, reports say. There is talk of another new ship.

Pilot Fred Jones fought a howling gale for 6½ hours, finally landed airliner and passengers safe at Hartford.

Once again Andre Kostelanetz, famed orchestra leader, has been awarded the title "most traveled air passenger" by four airlines. He flew 136,200 miles last year, made 52 trips, 23 of them between Manhattan and Southern California.

Lanny Ross (left), famed singing star, has rigged his new Beechcraft with novel equipment. It carries canopy, electric stove, water and bunks for four.

The New Harlow PJC-1



For a comparatively small airplane, the PJC-1 has exceptionally clean lines. Notice the trim retractable landing gear and smooth engine cowl.

THE trend of sportplane design ever wending its way in a turbulent tide of failure and success has reached a sudden climax duly portrayed by Max Harlow's new creation, the PJC-1. From the sportsman's standpoint it might be termed a "perfect specimen." Its designer, Max Harlow, is an engineer of note. His name has been associated with Waldo Waterman in the design of the "Arrowbile." He once was Kinner's chief engineer.

The PJC-1's compactness, outward appearance, and practicability exemplifies the experienced touch of its designer and builder. The same ruggedness of the modern all-metal transport is employed in the construction of the PJC-1, itself an all-metal airplane throughout. A chance look in the spacious cabin reminds one of the typical design of a Lockheed "12" fuselage with its "U"-shape formers and stressed skin. One large door, the size the sportsman pilot should like, gives access to the roomy interior where four people can sit comfortably with a wide range of vision in all directions. The cabin is also rather quiet as no large engine bellows in the ship's nose. In fact, the power plant is just a small 145 h.p. Warner *Super-Scarab*. Even so, the ship is said to top about 180 m.p.h. and cruise at around 155 m.p.h. The engine is well dressed with baffles and a tight-fitting full N.A.C.A. cowl whose trailing edge fits snug to the firewall.

Controllable pitch propeller can replace the present wooden one for a snappier take-off, even though it adds somewhat to the price of the airplane.

Down below is a very simple landing gear which retracts inward and completely out of sight when in the air. However, it is still of the conventional type and has not yet given way to the eventual conventional tricycle landing gear. The ship appears to be easy to handle on the ground though, and with the use of split trailing edge flaps landing speed is well within reason. The flaps resemble those on the Northrop attack ships with a series of holes to let air through, sufficient to prevent tail "blanketing."

There has been some argument as to the efficiency of this type flap by various engineers. The Air Corps, though, has accepted it for its attack ships.

The tail controls are fabric covered to reduce weight. Trimming tabs, retractable door handle, and those other modern minute features of the usual sportplane are to be found on the PJC-1.

The prototype shown here was built by students of the Pasadena Junior College, and we now hear that a company will be formed to produce this little ship in quantity. Such noted personages as Jimmy Dunn, film star, and Howard Hughes have piloted the PJC-1.

At this writing, the PJC-1 has not yet been granted an Approved Type Certificate.

New Jersey Markers

PILOTS following airways over Burlington County in New Jersey this summer will have the guidance of 50 place and direction signs now being painted by the Works Progress Administration workers on rooftops along main air routes throughout this New Jersey area.

Brilliant chrome yellow letters, spelling out the names to mark the locations of and directions to communities noted on air maps, will provide exact bearings and help prevent off-course crack-ups in the sparsely settled region between the cranberry bogs of central Jersey and the Delaware River.

Sponsored by the State Board of Aviation, and with the sanction of the Bureau of Air Commerce, the project will provide employment to eight men over a seven months' period, with the completion date set for July 1. It is estimated that 250 gallons of paint and 100 gallons of turpentine will be used.

In proposing the project, Richard Aldworth, chief of the State Aviation Commission, urged the provision of adequate place names, supplemented when necessary with mileage and directional arrows, to assure maximum guidance.

It was at Tabernacle Township, in the heart of Burlington County, that Captain Emilio Carranza, Mexican good will flyer, crashed to his death during an electrical storm the night of July 12, 1928, while on an attempted return non-stop flight from Roosevelt Field to Mexico City.

A monument, erected in 1930 from funds subscribed by the school children of Mexico, now marks the site where John H. Carr, and his wife and mother, of Catsworth, discovered the dead pilot amid the scattered wreckage of his plane while gathering huckleberries the day after the disaster.

Last year the Tabernacle Township Committee sponsored a Works Progress Administration project for the creation of a memorial park in the area surrounding the monument, and a seven-mile stretch of road was constructed by the WPA to permit pilgrimage to the isolated woodland spot where memorial services are held each year on the anniversary of the flyer's death.

The selection of locations and the placing of the signs is under the direct supervision of Gill Robb Wilson, state director of aviation.

As the most suitable marker locations are usually on private property, the board of aviation secured permission for the use of roof space on barns, warehouses, factories and similar structures, prior to the project's opening.

The sign for Catsworth, at the very center of the pine barrens of Burlington, will appear on the roof of a cranberry packing house, while the roof of a fence factory on Bordentown Road, Bordentown, will mark the latter place.

END

AVIATION on the FARM

by F. LELAND ELAM

This is the enlightening story of how the conservative farmer has enlisted the airplane's help.

The hard-working, dust-begrimed "farmer" pilot (right) loads his airplane with seed. A crop can be planted within a few hours.

"WORLD Headquarters for Agri-cultural Aviation. We do Everything Except the Plowing and Harvesting."

That is the slogan of the Willows Flying Service. The man who has made aviation and agriculture boon companions where fields meet airport at Willows, California, is Floyd Nolta.

The interesting history of aviation and agriculture's unity is in the making today and Nolta is playing and important part in it. In some phases it is well advanced while in others it is in its cradle days.

Probably the first use the farmer made of the airplane can be traced back to this very community where Nolta has his headquarters. In 1919, E. J. Moffett, who served in naval aviation at San Diego and settled near Willows after being discharged, realized the hazard wrought by the wild fowl in the rice fields. He inaugurated the famous Moffett Duck Patrol for the rice growers using two airplanes.

Two flights were made daily, and the planes, flying very low, proceeded to rout the ducks and drive them out of the rice fields. In those days ducks were so plentiful that in one night they would destroy as much as 40 acres of rice worth as high as $450 an acre. The patrol was a real service to the farmers.

The Moffett Duck Patrol was taken over in 1920 by William Moffett, a brother of E. J. Moffett, and Irwin Hunt of Woodland. During the years of operation these men had in their employ a number of excellent pilots, some of whom later became famous in the later development of aviation.

One of these men was the congenial Australian, Kingsford-Smith. His first flight across the Pacific ocean was planned in Willows and Moffett assisted him in obtaining capital and in preparations for the flight.

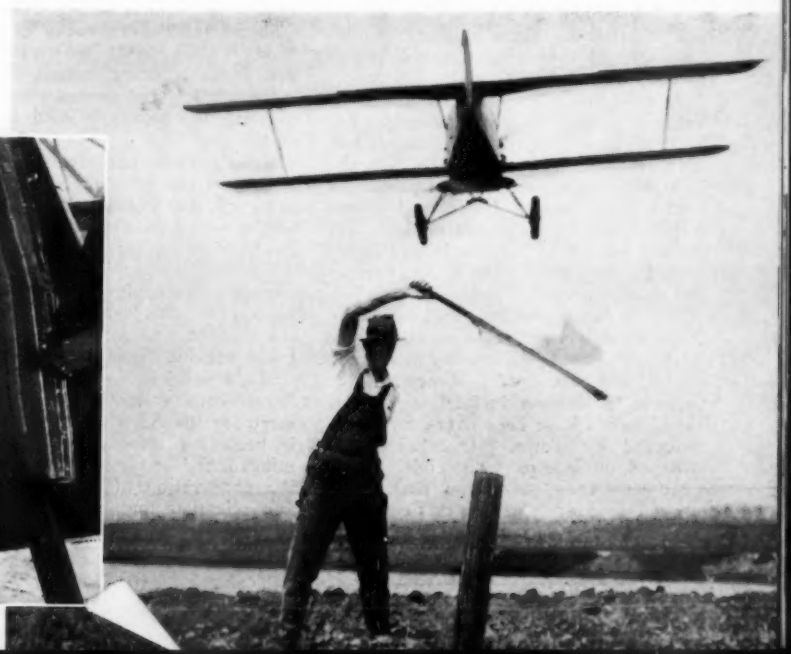
Holly Culver, one of the largest rice growers at that time, realized the major advantage of the duck patrol and bought two airplanes of his own to protect his 2,500 acres of rice. He used these not only for driving ducks from the fields but to fly over the land and inspect water conditions. He can claim the credit for having been the first rancher to ever invest in an airplane to use in ranch work.

Aviation history was made in 1927 when the first crop dusting was done

Though it's illegal in most states, some farmers shoot pests from the air.

The farmer at the right waves a cheery greeting as his aerial seed-sower zooms by overhead.

Even sick calves are picked up far afield and flown back to the nearest medical attention.



over cotton fields in Texas. Two years later Frank Gallison of Merced added another chapter by planting rice with an airplane for the first time. Gallison's success fired the ambition of Nolta, who was mechanic for the duck patrol after he had graduated from a wartime aviation camp. He put all his spare time into flying to gain sufficient hours in the air for a transport license. In the past ten years he has made 35,000 take-offs without a mishap, a world's record.

He was ready to try his new scheme in the spring of 1930, but the rice farmers were not, for an airplane was still new to them, and Nolta's plans called for a reversal of their former methods of rice planting. They were afraid they would lose their crops.

Under the old method the farmers sowed their seed with a broadcaster and then flooded the land. Floyd's plan called for flooding the land and then sowing the seed. It wouldn't work, they told him. The seed, they said, would float on top of the water and the mudhens would get it. Even if it did sink, they feared it would not go into the ground deeply enough to germinate. Also they claimed he could not spread it evenly with an airplane.

Persistence and belief in his project obtained several contracts for Nolta and he planted 7,000 acres that year. The work proved a revelation to rice farmers. The seed did sink at once. Mudhens could not get it. Also the spread was more even than that of broadcasters and it germinated more quickly. This gave the rice a chance to grow before it could be choked out by watergrass, and it in turn thusly checked the weed growth.

Today 80 per cent of the 130,000 acres of rice grown in California is sown by plane. Last season 16 planes took part in the work. Eight belonged to Nolta. The potential windfall for these aviators is over $100,000 and they often make as much as $300 a day.

Another important work of the agricultural aviator is crop dusting. Insecticides are sprayed over orchards and field crops such as tomatoes to kill the insects damaging them. The plane will return if the farmer desires and spread fertilizer, or drop chemicals which will in one operation kill weeds and injurious insects, and act as a fertilizer at the same time.

Rice growers who have had their crop sown by plane engage the pilots to come back in the fall to drive away marauding ducks and blackbirds, somewhat the same as the famous duck patrol. Range lands, which have been over-grazed, are reseeded by planes. Insecticides are dropped on infester grasslands.

It was four years ago that Nolta started to branch out from rice planting and crop dusting. That year he sowed 3,000 acres of oats for one farmer who wanted the work done in a hurry. The seed was dropped into plowed ground and harrowed in.

Barley was next sown by the same method. Wheat was planted last fall. Ladina clover and alfalfa are planted successfully by dropping the seed on moist ground. A big surprise came last year when Nolta announced he would plant several hundred acres of Egyptian corn. Impossible, the ranchers told him. Corn has to be drilled in and planted in rows. But he planted it with his plane—and the crop flourished.

Sheepmen have appealed to the flyers to help in the controlling of chicken hawks and eagles that molest their flocks. Coyotes, one of the most cunning and damaging of the predators, preys upon sheep, turkeys, chickens and pigs. Some pilots have set up regular patrols at the request of ranchers to kill and drive off these animals and birds that cause thousands of dollars loss every year. This type of work is the most dangerous the farming aviator undertakes. It requires flying over heavily timbered land, down rocky canyons far from landing fields where a crackup will probably bring instant death, and extremely low and around trees in order to bring the coyote or bird into range of the gun.

"Please, warden, can't I try it out just this once?"

Nolta's work has received so much attention that he gets letters from all parts of the world asking his advice on the use of the airplane in agriculture. He has had several opportunities to do dusting in Mexico. A Central American company asked him to help combat insects on banana plantations. An Algerian concern was anxious to know if he could use his airplanes in rain-making.

Nolta believes his lifework is in the Sacramento valley where he got his start, for the American farmer, he says, is becoming more and more aviation-minded, and as time passes he will with the cooperation of the aviation world and scientists find more uses for aviation in farming work.

Use of the airplane by the rancher is prevalent also in the cattle raising states where cattlemen have thousands of acres in their ranges, such as Nevada, Montana, South Dakota, Nebraska, Wyoming, Utah and Arizona. In Wyoming and Nevada stockmen have used the airplane to run down wild horses from the mountains to corrals built in the valleys. Wild horses are a serious problem when they descend by the hundreds during the spring down onto the cattle grazing land and destroy much of the food needed by the cattle.

Captain Albert E. Waite of Sacramento, California, and Ernie Moe of Woodland, have participated in airplane drives on outlaw horses. Bill Monday, a cowboy aviator, a few months ago at the insistence of cattlemen used his plane to drive down a bunch of wild mustangs from the Wyoming mountains where they had held forth for years, feeding on the rangeman's precious feed. The "fuzz-tails," driven into the corrals by the plane and ground crews, are sold to manufacturers of dog meat foods, and the drain on the stock feed is relieved.

Harry Minor of Hyannis, Nebraska, was the first of the cattlemen to add a new chapter to the history of aviation and farming a decade ago. He bought a small cabin plane and put it to work. Others followed; among which are Tom Arnold, operator of the 100,000-acre XU ranch in Nebraska and South Dakota.

Although it is very dangerous, much of the flying for the modern rancher who deals in big acreages and cattle and sheep, must be done over the mountain country. It is there that aviation is of greatest aid and value to the man whose wealth is scattered.

Much of the property is far from headquarters and the plane is used to take tools, food, saddles, bedding and such supplies to line camps, or wire and posts to points where new fences are to be put up or repairs made. Often injured calves are flown to headquarters where they can be doctored. The big boss can personally supervise the work in a dozen places on his vast acreages. Before the advent of the airplane it often took days to make the rounds and to keep track of the work being done, to see that fences were repaired, calves looked after, and water holes kept in condition.

When the cattle and sheep are ready to market the ranchers hop into their airplanes and bring buyers direct to the ranch to see the stock they are to buy.

The flying rancher finds his plane particularly valuable in the winter time to keep check on roads, available pastures, or herds of cattle—and sheep—that may become snow-pocketed in a canyon.

Excursions to the cities by plane saves

(*Concluded on page 74*)

THE NEW CESSNA "AIRMASTER"

THOUGH somewhat inconspicuous in the manufacturing field for some time, Cessna is producing one of the cleanest small airplanes in its class today. "Cleaned up" to the point where its performance/horsepower ratio is commendable in any airplane with the characteristics of the new Cessna, the *Airmaster* should do well this year.

Basically the same design used during the past several years, the *Airmaster* is nonetheless a new airplane. However, there have been the usual refinements expected from year to year and the latest model of this ship shows better performance than its predecessor.

Powered with a 145 h.p. Warner engine, the *Airmaster* has a rated top speed of 162 m.p.h. at sea level, which would probably give the ship somewhat better performance at its most efficient altitude. Cruising speed is listed at 143 m.p.h., while landing speed is 49 m.p.h.

The *Airmaster* is an economical ship, burning only 9½ gal. per hour at cruising and getting 15 miles to the gallon. With its standard 35 gal. capacity, the *Airmaster* has a cruising range of 525 miles. Allowance has been made for special tanks, however, giving the ship up to 785 miles of range.

Added to the new model Cessna is a wide speed-arresting flap extending between the landing gear. Wing flaps have been eliminated.

HOLLAND

Though a tiny nation by comparison, Holland is one of the most modern of the world's air-minded countries.

Best-known of Holland's airports is Schiphol (above) outside Amsterdam.

Fokker military ships set standards in Europe. Above is a C-11W reconnaissance seaplane of the Dutch Navy.

Dutch Army reconnaissance squadrons are equipped with Fokker C-10's like that above. Top speed is 212 m.p.h.

PROBABLY but few of the aviation enthusiasts of this country recognize the name "Koninklijke Luchtvaart Maatschappij voor Nederland en Kolonien", yet when the initials K. L. M. are mentioned we immediately think of that excellent organization The Royal Dutch Air Lines. Since its inception in 1920 K.L.M. has become one of the most traveled airlines in Europe and the East. Herr Plesman, organizer of K. L. M., is recognized throughout the world as one of the ablest men in the air transport business. Likewise has the name of the eminent Dutch designer, Anthony H. G. Fokker, been a byword in aviation. Just as the forefathers of these famous Netherlanders pushed the realm of civilization far into the unexplored territories of the New World these modern pioneers in the newest of industries, aviation, are again making their small but important country famous.

It is interesting to explore more fully the story of this midget among kingdoms and the great effect it has had on world aviation.

The immense success of Fokker aircraft by the German Air Force in the World War is well known. Since the end of this conflict the Fokker company in Holland has turned out great numbers of highly successful ships. Fokker-built aircraft are now in service in 30 countries, 16 of which have also acquired the right to build these ships under license. In addition a total of 49 air transport companies are now using Fokker equipment. There are few aircraft companies in the world who can boast of such a record of universal use of their products. Present equipment of the Dutch Army Air Service is almost wholly of Fokker make, although a number of new Koolhovens are being put in service. Fokker S-4 trainers, C-9 and C-10 observation planes, C-5 general purpose biplanes, F-7A bombers, and D-16, 17 and 21 fighters are in use. The Naval Air Service uses almost wholly Fokker equipment, of types S-3, C-1, D-7, C-5, C-7W, T-4, C-11W and others. Many ships of these and later types are also in use in the Indies Air Force. A number of the new Martin 139-W bomber have but recently been shipped to the Indies for service, and a number of Curtiss *Hawks*, built under license by the Aviolanda Company, are being used in pursuit squadrons.

Probably the most interesting of the later Fokkers is the low-wing D-21 fighter. Construction follows the usual Fokker type; wing is of wooden plywood type and the fuselage is of welded steel tubing. Any liquid or air-cooled engine of from 600 to 1,100 h.p. may be mounted, although a Bristol *Mercury*

Koolhoven is noted for its modern, well-designed ships. Below (left) is an FK-51 advanced trainer. Directly below is a trim FK-52 two-seat biplane.

A MIDGET AIR POWER

Proof that Holland is far from backward is this 277 m.p.h. Fokker D-21.

by GORDON SEAR WILLIAMS

VII is ordinarily used. Span is 38 feet 5 inches, and length is 26 feet 3 inches. Armament consists of one 20 mm. cannon and either two or four machine guns mounted in the wings. This armament is specified with the Hispano V-12 model. When using a radial Bristol or Wright *Cyclone* armament consists of two machine guns in the wings and two synchronized guns in the fuselage. As an alternate arrangement, two cannon may be fixed in the wings, and two machine guns may be mounted in the fuselage. Top speed with the Hispano engine and retractable landing gear is rated at 295 m.p.h., while the Bristol *Mercury*—powered job, with a fixed landing gear, does 274 m.p.h.

A very unusual twin-engined Fokker made its debut at the Paris air show last year in a somewhat unfinished state. Since that time, final adjustments have been made and test flights have shown it to have some excellent features. This ship, the G-1, has been nicknamed *Le Faucheur*, which literally means "The Mower", a very apt name for this ship. It has one of the most comprehensive armaments ever incorporated in a ship of this type. Although designed primarily as a ground attack and fighting ship, it can also be used to advantage as an observation plane or light bomber. Armament consists of two forward firing automatic 23 mm. cannons and two fixed machine guns. In addition the rear gunner is provided with a flexibly mounted machine gun which is completely enclosed in a rotating turret. A top speed of 292 m.p.h. is attained when equipped with two Bristol *Mercury VII* engines and a climb to 26,000 feet takes but 16 minutes. A range of 965 miles is available with full gas tanks and maximum armament load. Construction is a little unusual in that metal monocoque members are used as tail booms. The wing and fuselage are of wood.

Some interesting data were made available when this ship was recently released for export. As air duels of the future will likely last but a few seconds, due to the ever-increasing speed of airplanes, Fokker decided to mount four forward-firing guns on the G-1. Especially interesting is the installation of the two Madsen 23 mm. automatic cannons. This lethal weapon has a trajectory of upwards of 1,800 feet and has a belt-fed chamber, providing for the loading of an unlimited number of shells at one time. Most cannons of this type have a circular magazine which limits the rounds to about 60. The Madsen cannon can fire 20 shells in three seconds and is entirely automatic as far as actual

This Fokker fighter, now in standard use by the Dutch air force, resembles Fokker's deadly World War biplanes.

Another Dutch observation ship is the biplane above. Note its close resemblance to the famed Fokker D-7.

Top speed of the Fokker D-17 directly below is 234 m.p.h. Compare this with the estimated 338 m.p.h. top speed of the Koolhoven FK-55 (right).

operation is concerned. Ten second explosion fuses are fitted to the shells so that no friendly troops will be damaged if the shells miss their mark. Although one of these explosive shells would probably not put a large aircraft entirely out of action it is thought that it would so handicap the crew that an actual victory could be speedily attained by the attacking ship.

The Fokker C-10 two-seater observation-fighter is one of the main units in the present Netherlands Air Force. This taper-wing biplane is not greatly different from previous Fokkers but has some unusual features in design. As used by the Air Force in Holland the Rolls-Royce *Kestrel* is standard equipment, while for export any engine from 600 to 1,000 h.p. may be utilized. The fuselage is of welded steel tubing and both wings are of all wooden construction, having portions fabric covered. The Hispano-powered job is equipped with a cannon which fires through the propeller hub. It can discharge 400 rounds per minute and is operated by compressed air which is stored in a tank by an engine driven compressor. A Madsen machine gun which fires 1,200 rounds per minute is synchronized to fire through the propeller disk and the rear cockpit mounts a similar weapon flexibly attached. Top speed of the C-10 is 262 m.p.h. and service ceiling is 27,200 feet.

The other important manufacturer of aircraft in the Netherlands is the Koolhoven Vliegtuigenfabrik of Rotterdam. Fritz Koolhoven was one of Europe's aviation pioneers and together with M. Bechereau designed the now-famous Deperdussin racing monoplanes. In 1922 Koolhoven moved to England and started a British branch of the Deperdussin Company. With the closing of this firm's doors he joined the Armstrong-Whitworth Company where he remained until joining the British Air Transport Company, Ltd. It was here that the famous B. A. T. ships were evolved. After another unfortunate closing, Fritz Koolhoven returned to his native Holland where he has remained since that time.

One of the most radical designs to appear in the past year is the tiny Koolhoven FK-55 monoplane fighter, which employs two propellers geared to one engine. Great credit must be given to the design staff of the Koolhoven works for this ingenious arrangement to eliminate torque and provide for an unexcelled field of vision for the pilot. The use of the two propellers, running in opposite directions totally eliminates the adverse effects of torque and makes the ship easy to fly at all times. By mounting the engine well back in the fuselage the pilot is enabled to sit forward of the wing, straddling the drive shaft. Although the experimental ship, which mounts a Lorraine *Petrel* engine of 860 h.p., is of wooden construction, metal can, and likely will, be used for future ships. Armament consists of a rapid-firing automatic cannon firing through the propeller hub, and either two or four machine guns mounted in the wings just outside the disk of the propeller. Estimated performance called for a top speed of 323 m.p.h. and a cruising speed of 279 m.p.h. Actual figures have not been divulged but it is said that "tests were most satisfactory."

Other Koolhoven machines which are probably not so well known include the FK-51 two-place trainer-spotter, and the FK-52 two-seater fighter-observation plane. The former ship is a very trim looking little biplane, mounting a Siddeley *Cheetah* engine of 350 h.p., and having a top speed of 157 m.p.h. Wings are of wooden type, having a plywood covering. Tail surfaces and fuselage are of welded steel tubing, having the usual fabric and metal plate covering. A machine gun may be mounted in the upper wing and a flexible gun can be accommodated in the rear cockpit. Radio, camera, and other Army equipment may also be carried.

As a development of this ship the FK-52 fighter has recently made its appearance. Single strut cantilever legs form the landing gear. Wings are of wood, and the fuselage, with the exception of a small wooden section at the tail, is of welded steel tubing. The tail surfaces are of full cantilever type and are of plywood and spruce construction.

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Fokker named this deadly fighter "The Reaper." Fitted with two machine guns and two cannon, this attack-bomber boasts a high speed of 301 m.p.h.

New Plating Process

This piston was taken from a scrap heap and given the Krome-Alume test.

FOR many years, electrochemists have been searching for a practical and simple process for plating aluminum with ordinary plating room equipment. After 17 years of searching for the answer William J. Travers, a Buffalo, N. Y., chemist has finally found what it is believed to be the correct method. Eastman Kodak Company was among the first of the larger concerns to recognize Travers' rights and to apply for and receive a license to use the process.

Aluminum plated with a hard, brittle metal like chromium not only demonstrates high resistance to corrosion but, what is more important, to moving rubbing parts, and high resistance to wear also. Also a large unit in the aviation industry has employed chromium plated, aluminum pistons in the cylinders of small air brakes and a large automobile manufacturer has shown that chromium plated aluminum pistons in engines fail to show appreciable wear after thousands of miles of travel. It is felt that the application of this process will immensely widen the use of aluminum parts in both the important branches of the automotive industry.

Perhaps the most important feature of the Travers' patent, at least from a practical shop standpoint, is the extreme ease with which it may be applied without special equipment and by practical platers who need only brief instructions. The process is initiated by subjecting the aluminum article to anodic treatment in a mild acid bath. After this anodic film is modified in an alkaline bath, the article is ready for plating in standard solutions with ordinary current density and ordinary time values. Only a few moments are required in the preparatory process.

Electrochemists who have investigated the matter, are amazed and indeed

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I SOLOED in 3½ HOURS

by PAUL W. LINDBERG

Our model editor did so well learning to fly that it made a worthwhile yarn.

One of the pilots gives Lindberg a few pointers before a flight.

HAVE you ever had your mind suddenly wake up to the stark realization that you're doing something you never dreamt of doing? Have you ever suddenly snapped out of a trance and found yourself driving mechanically down a road you don't even recall turning on to? Well, I snapped out of a sort of dreamlike trance one day to find myself flying 1,000 feet over Sky Harbor airport (near Northbrook, Ill.), behind the rear set of controls of a *Cub*. The stick between my knees was waggling back and forth as the fellow in the seat ahead of me waved for me to take over and fly the ship. . . .

I'd had no more intention of learning to fly than I have of being a fan dancer. Yet here I was sitting up in the middle of the sky with the controls in my hands for the first time in my life. The fellow up front was a good friend of mine, Norman Doerr, and we were flying in his ship. Actually I had come out of sort of a fog to find myself getting my first instruction as a pilot. Little did I dream that, within *3½ hours* I was to be sitting in practically that same spot over the airport *all alone in that airplane*—solo! . . .

Norm's the disarming sort of a guy who has you doing something he wants you to before you realize you're doing it. Norm just decided that my lukewarm desire to fly had to be encouraged, so he went to work on me. And what a job he finally did!

Until that most memorable (to me) day in September, all my flying had been devoted to those little gas-engined models I've been building for POPULAR AVIATION these past months. I guess I'd never given any serious thought before to sitting in behind a full-sized set of controls and flying around the sky to wherever the spirit moved me. That's undoubtedly why I was so surprised just to suddenly find myself up in the air and flying an airplane.

It seems that, during one of my frequent visits out to the local airports (any air-minded fellow generally turns out to be what flyers call an "airport gopher"), I had made some mention that I'd like to try flying Norm's ship. Being that kind of a guy, Norm decided that, inasmuch I was thinking such things, I unquestionably should be doing them. So he showered me with the best aeronautical psychology and I soon found myself being prodded and pounded by a Bureau of Air Commerce medical examiner. I walked out of that office with my student permit.

I had a date with Norm early on the morning of September 21 out at Sky Harbor. A chilly wind was blowing gustily when I arrived but Norm greeted me all smiles. I insisted (somewhat fearfully) that I had to be home "early".

"Say", he suddenly poked me with his finger. "I'll bet you that you can solo this *Cub* before you leave the field today."

"Aw", I awed him, "such things aren't done". But then I got the idea that that would really be "something" if I *could* solo in such a short time. So one remark led to another and, before I knew it, I was all tied up in a bet that (according to

Instructor Norman Doerr (right) bids the author good luck on his solo hop.

Norm) I would have soloed before I left the airport—*and with perfect safety.*

As I said, the wind was somewhat gusty (which isn't the best thing especially when you're flying a lightplane). But off we went anyhow, me in the back seat and Norm lounging easily in front of me.

"When I signal", he had told me, "I want you to put your hands and feet on the controls *very lightly* and carefully follow all the movements I make as I maneuver the ship."

I got that signal much sooner than I expected. Believe me, I was so nervous as I eased my hands and feet toward those controls that a bump at that moment would have made me jerk away from those controls like a frightened rabbit.

It wasn't long, though, before I was going through the motions of flying the *Cub* with a great deal of interest. The ease with which Norm compensated for each up- and down-draft sort of fascinated me. The slightest pressure on the stick or rudders did the trick. I was taken aback, more by the simplicity of the thing than anything else. Before long, Norm had turned over the controls to me entirely and I'm here to state that *that* is a feeling—more thrilling than anything but the first solo flight itself.

Round and round the field I circled. I was plenty sloppy at first. My caution had turned into just enough confidence to cause me to overcontrol time after time. But I got around the airport several times—and felt as though I'd whipped the world single-handed.

Ever so often we landed and rested awhile. After about my second "rest" I was all set to solo—in my own mind. Norm, though, had other ideas.

"Hmph!" he scowled at me. "Bet or no bet, you won't leave this ground alone until I'm darned sure you're ready to go. So don't get any more funny ideas. You've got plenty to learn yet."

That cooled me off. Back up into the air again. Confidently I settled onto the controls at his wave. Shallow banks. Ooops, too much rudder. Now I've concentrated so hard on getting that rudder just right that I find myself flying around with my right wingtip flying along almost below the bottom of the fuselage. Norm just sits there and grins derisively at me. A gently savage side jerk on the stick brings the wing up in a flash—and Norm bawls loudly at me something to the effect that I'm not driving a truck "so take it easy, dope!" I take it easy after that.

The shallow banks turn into verticals. Then figure eights. These are hard, all right. Only practice will iron them out. Then spins. The spins are what I've been waiting for. If you can do all right on them, you're a pretty normal pilot—usually.

At first I was a little afraid of spinning down the sky in that little ship. But Norm reassures me with a wave, takes over the controls and down we spin. One, two, three turns. Suddenly the world stops spinning, starts to fly right in your front window, then skids down to its normal

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Narrow Escape!

Note damaged wing and lowered flaps.

AN unusual wartime incident was reported to POPULAR AVIATION by a Japanese correspondent, and the above rare photo was sent along as proof.

According to the report, the Japanese pilot flying the above bomber had his ship hit by an anti-aircraft shell during a raid. As seen in the picture, the left wing was badly damaged. The pilot, however, managed to nurse the crippled ship to a safe landing.

Attention, Pilots!

A HANDY little book, containing a mine of valuable information for professional and sportsmen pilots, has been made available by the Aviation Radio section of the RCA Manufacturing Company.

Its 132 pages contain useful information and data for planning flights, and for "blind" instrument flying. Compiled after nearly a year of effort and with the wholehearted cooperation of more than 600 radio broadcasting stations, the book has data on aircraft radio, radio-compass flying, obtaining true bearings of broadcast stations from nearest airports, distances from airports, obstruction lighting, height of towers, radio call letters and the frequencies of transmitting stations. The stations are listed alphabetically by state and city.

More than a dozen pages are devoted to an up-to-the-minute kilocycle index of United States broadcasting stations listed by frequencies. U. S. radio-beacon weather stations are listed alphabetically by state and city, by frequencies and by identification letters, as are also the U. S. airport traffic control stations.

END

New Air Course

A TYPE of aeronautical engineering training never before attempted was launched on February 1 by the Aero Industries Technical Institute, Los Angeles, according to an announcement by James L. McKinley, managing director. McKinley states that the new areonautical engineering course correlates aircraft design with production problems and technique. This is accomplished through training the student engineer in airplane manufacturing practice, in the extensive Aero I. T. I. shops, as a part of his engineering course.

Prior to offering this course, Aero I. T. I. courses included only the construction phases of airplane building. But so great has been the need for engineers trained both in the theoretical aspects of engineering as well as the practical problems that the new course was considered essential to the training program of this "industry-supervised" school.

The Aero I. T. I. aeronautical engineering course requires a year for completion, and the training embraces three phases: (1) theory study in the classrooms, (2) drafting and drawing instruction in the spacious drafting rooms of the Institute, and (3) practical training in the school's 17,000 square foot shops.

Smuggler Trouble

ENGLAND is having her troubles with aerial smugglers. The traffic in smuggled materials (largely drugs and jewelry) has become so heavy of late that the British have established an air base near Maidstone where high speed government airplanes will patrol the English side of the Channel on the lookout for high-flying smugglers from France or Belgium.

Britain's coast patrol ships are of the latest types equipped with two-way radio.

Binary Engines?

THERE has been much talk for many years on the subject of binary engines for airplanes but very little has actually been done about it. In such engines, be it understood, fuel is burned in the primary gasoline engine and then the heat from the jacket and exhaust are employed in creating pressure in a second cylinder mounted on the same crankshaft. Usually, this pressure is accomplished by heating some volatile liquid (such as ether) and this vapor pressure operates the second cylinder like the cylinder of a steam engine.

I believe that there is a future for a binary engine in the matter of improved efficiency and greater output but this is a matter that would require a considerable amount of expensive research work and a considerable period of time, but eventually it would work out to the benefit of all.

IRISH THUNDERBOLT

An Avro Anson for Ireland's air force streaks past during war-flying practice.

Aerial

by CHARLES M. EMERSON

Nature's majestic wonders offer scenes like these to the aerial explorer. These mountains were never before seen by white men.

THE most fascinating entertainment to be found lies in turning back the pages of history and uncovering the secrets of the past which have long been sealed in the tomb of time.

Until comparatively few years ago, man was an animal living in a world of two dimensions held against the length and breadth of the earth by the pressure of gravity. He was so close to the ground that he stumbled over obstacles of major importance without recognizing the fact that they were keys which would unlock the secrets of by-gone civilizations.

Deep in wild Central America an exploring aerial camera recorded the above ancient Inca arenas and the centuries-old ruins below.

The aerial explorers land and set up their cameras on the above sand dune.

In recent years, man has built himself wings. He calls them airplanes. Now he perches himself on elevations high in the sky and many of those objects over which he stumbled previously, now are spread before him to wide horizons and he is able to read the struggles of older races and envision the rise and fall of great civilizations of the past.

A few years ago in England there was an area of uneven ground over which people had walked for centuries without realizing what the ridges and depressions on the landscape really portrayed. An aviator flew over this area and photographed it vertically downward, thus creating an aerial photographic map of that particular locale. Upon development of the photograph, it exposed to public gaze the fact that here was the site of an ancient Ro-

Exploration

The cameras of these adventuresome American airmen have found ancient ruins in Peru that will go down in history.

man city with the streets and buildings clearly defined.

A few years ago Robert Shippee, president of Aerial Explorations, Inc., New York, as pilot with Valentine Van Keuren, secretary and treasurer of Aerial Explorations as civil engineer and the late "Tuck" Johnson as aerial photographer, successfully conducted the famous Shippee-Johnson Expedition to Peru.

From their observation laboratory in the sky, they discovered the Great Wall of Peru and the ruins of many ancient forts which were part of the great defense system of the Chimus against their conquerors the Incas.

They discovered the Valley of Volcanos and photographed from the air many ancient ruined temples, tremendous fortifications and portions of the great Inca road which was built centuries ago and paved from Quito to Cuzco in an unbroken line for two thousand miles.

We marvel at the extent of knowledge and engineering ability displayed by ancient races whom we, of the civilized era, smugly call Barbarians.

The photographs show a huge wall composed of blocks of stone, some of which weigh 150 tons and which are so closely fitted that today a knife blade cannot be thrust between their surfaces, with puzzlement. We repeat and repeat the question: "How could these primitive engineers do it when we consider that they did not know the use of the wheel or the construction of the keystone in an arch?"

Here were great civilizations which proved their ability as engineers and had even perfected the art of the polishing of gems and who had perfected sculptural portraiture.

The members of the expedition took aerial photographs of the fortress of Fortaleza which was part of the Chimu defense system. This fortress was huge and was constructed at a time which lies behind the veil of antiquity.

Although recorded data is not available, it is stated by persistent legend that an army of 200,000 Incas laid seige to this fortress without avail and were finally forced to march up into the upper reaches of the Andes, around the Great Wall and down on the other side to a position where they could cut off the water supply of Chan-Chan, the Capitol of the Chimus, before they could conquer the people.

As we study the great defense system built by this prehistoric race and marvel at the size of Fortaleza our imagination can people its walls with defenders using queer implements of defensive warfare against the horde milling around its walls ever raising scaling ladders in futile attempt to pierce the armor of this great fortress.

The photographic map section of the ruins of Chan-Chan shows a great metropolis, brilliant with the many harmonious colors of its stained walls and glittering with the trappings of pomp and ceremony of a rich and ancient race of people.

Entire states are now completing arrangements to have their areas photographed from the air. From these maps the State Forestry Division unerringly locates denuded areas which cry for reforestation. They can select those sections which should be reserved for state parks and preserves.

From the photographic maps they can determine primitive stands of timber, secondary growth, scrub brush, burned-over areas, rock out croppings, and blow downs. The Agricultural Division will use these maps for soil analysis, land classification, study of the sub-marginal land problems, estimation of crop capacity, etc. The Department of Public Works will use them for location of new highways, study for flood control and many other uses too numerous to classify.

In fact any Federal, State, County, or Municipal problem which demands complete detailed information can be much more easily solved by the use of an aerial survey than by any other known means due to the fact that the aerial photographic survey gives full photographic detail showing every house and tree, also gives

The expedition's Bellanca is left by a dune while its crew explores afoot.

Below are two ships and some of the equipment used on the flights into Peru. Note the various types of cameras used.

Not all the work of Aerial Explorations, Inc., is in unmapped wilderness. Robert Shippee points out U. S. sections to be photographed to Valentine Van Keuren.

a high degree of accuracy, and in addition by means of stereoscopic study permits the executive, planner or engineer to view the entire area under study, in relief of terrain. In other words any two overlapping photographs may be studied in the third dimension or perspective.

This is fact and not theory because by precedent of past performance all of the uses mentioned above and many which space does not permit mentioning have put aerial photographic surveys to the acid test of practical application. In every case the photographic map has come through with flying colors.

Truly aerial photography spans the centuries. Now, and in the future, and as has always occurred in the past, man springing from a common source is proceeding to the same eventual destiny, but in the future the transitional cycles as they occur will be permanently recorded by the aerial engineer and explorer.

It may interest the reader to know a few of the fundamental facts governing an aerial photographic survey as it is distinguished from the aerial photographic oblique. The latter is a photograph taken at an angle from the vertical, over the side of a ship showing objects on the ground below in the form of a photograph which cannot be scaled for accurate measurement. These photographs are used for advertising, industrial plant study, some phases of planning and for purposes of general reconnoissance information.

On the other hand the aerial photograhic survey produces a map which gives the complete detail of a photograph plus the factor of accuracy so that objects may be measured and scaled on the resulting photograph or enlargement.

The first question always asked when the non-technical observer sees an aerial photographic map, is "How high was the plane when this photograph was taken?

A very simple mathematical formula determines this elevation of the plane. For instance if it is desired to have the negatives to a scale of 1"-800' and the focal length of the lens to be used is 20 inches then the multiplication of these two factors 800 by 20 equals 16,000. This is the elevation in feet which the plane must maintain in order to secure negatives to a scale of 1"-800' using a lens of 20 inch focal length.

Due to new chemical process, Aerial Explorations, Inc., are able to extend the range of service to engineers by giving a greater flexibility of enlargement from these negatives. At the last New York Aviation Show two murals were shown at

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For the elaborate mosaic aerial mapping, special developing and printing equipment is necessary. Some of this can be seen above. Note photos and maps on wall.

Soviet Air News

REPORTS to POPULAR AVIATION from Russia, through the International Air Press, tell of great advances already made and others, being planned in the Soviet civil aviation scheme. Until recently, Russian commercial aviation has been devoted almost entirely to the airline network within the Soviet republic itself. Only Russian airline connections with the outer world has been the Moscow - Prague, Moscow - Stockholm and Moscow-Cabul lines.

According to the report to this magazine, Russia's airlines totaled three companies operating 2,484 route miles in 1923. In 1937, however, Russian airlines were flying 34,155 route miles and an estimated 180,000 passengers were carried.

Great increases in civil aviation is planned for the period from 1938 to 1940. Prospects are bright for an airline over the North Pole to the United States. Several polar flights, some to the United States, during 1937 have proved an airline over this route feasible. There is a Soviet air base at the Pole itself at present. In addition, Soviet aviation officials are encouraging the use of aircraft for various peacetime tasks.

A Spin Record?

WHILE flying an Italian-built Fiat CR-32 pursuit ship on patrol over Austria one day recently, Lieut. Muller Rienzburg of the Austrian air force unwillingly established what is believed to be some sort of record for spins.

According to POPULAR AVIATION'S correspondent in Europe, Lieutenant Rienzburg was leading a flight at 24,600 feet when his oxygen apparatus broke down and plunged him into sudden unconsciousness. With its engine still running at cruising speed, Lieutenant Rienzburg's ship fell into a tight spin as he slumped over the controls.

The speed at which the engine was running caused the fighter to fall into an extremely tight spin which it held, according to a barograph installed in the ship, for 16,400 feet before the unconscious pilot recovered enough to right the ship. This is believed to be one of the longest spins on record, particularly with power on. Lieutenant Rienzburg and other members of the flight estimate the ship snapped through at least 50 complete turns in its long fall from the sky.

"My airplane righted itself at about 6,800 feet as consciousness came back to me," Lieutenant Rienzburg told POPULAR AVIATION'S correspondent, "and I was surprised and frightened to find myself just over a chain of mountains that rise 6,560 feet high. Anyhow, my barograph registered a fall of 16,400 feet in a little more than two minutes."

Lieutenant Rienzburg landed his ship safely and the airplane was found to have suffered no damage.

END

Yukon Yeoman

Recruited from American airline flying was this Pilgrim monoplane. Note the wing mount for a recording aero-meteorograph.

Pilot Harold Gillam

The author (above).

by LEONARD DELANO

Up in Alaska Uncle Sam has a hardy airman by the name of Harold Gillam to keep an eye on the weather.

A LONG slender streamer of white, momentarily hanging suspended in the still, frigid air every third morning this winter over Fairbanks, Alaska, marks the path of an interesting exploration in the North country.

For the weather flight plane, whose roaring exhaust marks its climbing passage over Fairbanks, is as surely making exploring history of its kind as other better-known explorers have made in their travels over northern areas.

One morning in early March, 1937, I was working to help prepare some log cabins at the edge of Fairbanks for a Hollywood motion picture production. Though more snow lay on the ground than usual from the record snowfall of January, it was a typical Fairbanks winter morning. The air—10 or 15 degrees below zero—was very still and the atmosphere clear as crystal. Smoke from nearby log cabins and the modern buildings in downtown Fairbanks ascended lazily, unwaveringly. There was very little sound, and the occasional barking of "Rabbit" Joe's dogs and an infrequent howl of some dog over in the opposite direction punctuated the morning stillness like exclamation points.

Then the roar of a plane on the opposite edge of town from our movie location broke the silence. A silver monoplane rose above the vertical ribbons of smoke, the noise of its 525 h.p. *Wasp* rising to a thundering crescendo, then slowly dying away. Less than 10 minutes later it was lost to view as it climbed in wide spirals above Fairbanks.

"It's not cold enough for him here, so he's going up to get some fresh air," jokingly remarked one of the fellows working on the location.

The "fresh air" was a polar air mass, and Pilot Harold Gillam was taking one of his routine "peeks" at it from more than 16,500 feet high for the benefit of the U. S. Weather Bureau and its representative, W. B. Drawbaugh. Cold indeed was some of the upper air that day, but it had been 50 and 60 degrees below zero on other trips and was comparatively mild for this farthest north weather hop pilot.

About one hour after the silver monoplane had taken off, it appeared in view again, and soon descended on the hard-packed snow of the field where I had gone in the meantime. While Drawbaugh removed the aerometeorograph with its records from its frame under the left wing, Gillam started the oil draining from the motor and commenced buttoning up the ship's nose with the conventional canvas. And here I had my first close observation of Far North weather flying.

Harold Gillam, whose most recent feat in December, 1937, has been to fly by moonlight over the treacherous Endicott range to Point Barrow on a charter trip for searchers of the lost Russian flyers, is

Before each weather flight the aerometeorograph is placed in its mount.

one of Alaska's most capable birdmen. Routine of the weather flights palls in comparison besides some of his northern exploits, the completion of which have required experience in cold weather flying, liberally applied with intestinal fortitude.

It was Gillam who, with Joe Crosson, was in the forefront of the famous hunt for intrepid Ben Eielson on the latter's tragic flight to Siberian icy wastes. Bucking the frequent frustrations of the North, Gillam has built himself up a fund of experience which few living airmen have of cold weather flying.

Few flyers, for instance, would have even thought of making the daring mid-winter flight to Point Barrow over the treacherous Endicott range to the north of Fairbanks. Yet, in the dark with only the light of the moon and the stars, in a country where radio beacons are as scarce as banana trees, Gillam and his flight mechanic, Eddie Wisler, accomplished the feat. The world has heard much of the tragic crash of Wiley Post's plane near Point Barrow in midsummer, but it should also hear of veterans like Gillam who travel over the Arctic wastes as a matter of course many times a year to earn their bread and butter.

But what, you may ask, has this to do with weather flights?

The answer is that the Weather Bureau is fortunate in having experienced cold weather pilots who know the whims of northern weather in the land where winter begins.

Though it may not require the indomitable courage of a Point Barrow pioneering flight, you must not get the mistaken impression that weather hopping in Alaska is child's play. Quite the contrary. It has its problems and plenty of them. Snowstorms for instance.

During the first year of established weather hop flights at Fairbanks, the winter of 1936-37 had the greatest snowfall on record with 133.5 inches, though the greatest depth on the ground at any one time, not counting snowdrifts, was 62 inches. January was high month with 65.6 inches of snowfall, and it must be admitted that getting caught above one of the snow "flurries," or in it for that matter, presented a bit of a problem. Bert Lein, later the flyer at Fargo, North Dakota, for the Weather Bureau, was weather flight pilot for Gillam Airways while Gillam was out on his regular route trips with his other plane to Cordova and Valdez. During the winter of 1937-38 Pilot E. E. Parmenter of Gillam Airways has been doing much of the weather flying while Gillam was out on other trips.

Fortunately, snow at Fairbanks is light and dry, wind is light and variable and blizzards are very unusual, according to records of J. Adams Frost, senior weather man there. Snowflakes are small and powdery, rather than large and flaky. Though the interior Alaskan climate is comparatively dry, the September and October change-of-weather periods, as well as certain spring periods, cause icing

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"Clear and Unlimited"

By SWANEE TAYLOR

If Wives Only Knew . . .

In some quarters it is still firmly believed that the greatest single deterrent to passenger flying is that great American institution known sundrily as The Ball-and-Chain, or, The Missus. And the argument put forward to support this belief is that wives cling to an age-old fear of having their babies left fatherless and foodless. However, and at the risk of seeming cynical, I must say that . . .

If a lot of wives knew that each airline passenger is insured up to $100,000 they would drive hubby-dear out to the airport themselves and see to it that he used nothing else but air transportation.

Speaking of Insurance . . .

Late last summer this department pointed out that the insurance underwriters were getting tired of paying-off on account of "pilot error" and that they were quietly going up and down the lines spotting the violators of rules and regulations.

Well, this spring will see quite a few new faces up front in the business-office of the airliners. And you can bet a cookie that the underwriters had more to do with it than any other one cause. And, what's more, they have just begun to ride herd on the pilots. Which, come to think of it, isn't such a bad idea at that. After all, human life and company property are deserving of the utmost protection and safe-keeping.

Another Clipper Angle . . .

What follows below is the opinion of a high-ranking Naval Officer whose name, quite obviously, can't be mentioned here. It is offered as more grist for your mental mill in connection with the *Samoan Clipper* tragedy:

"About the Pan-American explosion. I may be quite wrong but I have always felt that dumping gas at an altitude is extremely hazardous. The Slipstream plus the skin friction of the air on the bottom of the hull churns up both air and the gas being dumped. And the final product is much the same as that the carbureter delivers to the cylinders—a more or less explosive mixture. On the other hand, if a plane had to dump gas it should get down to five or ten feet off the water and head into the wind before dumping. The shortness of time, before the gas hit the water, would prevent an admixture of gasoline and air to a degree where it would become an explosive.

"Furthermore, sparks from the engine could not possibly, during flight, meet the gasoline or gasoline vapor until both are a considerable distance behind the plane. But by then—at low altitudes—the gas would have already struck the water and any vapor would have been condensed. The only way the explosion can reach the plane, higher up, is for a spark to ignite the gasoline vapor some distance astern of the ship, and then for the explosion to travel by progressive burning (faster than the plane's airspeed), up the line of gasoline vapor to the dump-valve.

"Incidentally, the Department of Commerce issued instructions, prior to November 1st, 1937, forbidding the use of gasoline dump-valves in flight BECAUSE OF THE FIRE HAZARD! Of course, that prohibition was qualified by saying 'except in an emergency' and therefore Musick may have been acting in what he considered an emergency. So we can't criticize him for that."

About the only thing the Naval Aviator did not consider was the fact that during the dumping operation the ship's cabin becomes filled with the explosive vapor, which leaves the possibility that a spark from the radio set or many another source might have furnished the fatal ignition.

At any rate, the sad affair is still too dreadful for words. Especially so since it took from us beyond all doubt the biggest pilot-contributor aviation has yet known, Capt. Eddie Musick. And a touch of mournful irony lies in the fact that master air mariner though he was, Eddie Musick never for an instant ceased studying. Even as he died *he was actually going to school.* His last paper had just reached the corrector's desk at the International Correspondence School, in Scranton, Pa. (who do the correcting for Pan-Am's own special study courses), an hour before his life was snuffed out.

The Chicago Show . . .

It is too early to give a final tabulation of the $'s and c's figures on the International Air show currently being held at Chicago's magnificent International Amphitheater. I say it is too early because your devoted correspondent won't be able to see the show through. Thanks to the marvel of our aerial age and to American Airlines, he will bounce down home to Texas for the week-end. Besides, Max Karant is probably doing a swell coverage of the Show elsewhere in this issue.

However, it would be neglect of duty for me not to pay tribute to the grand Gumption of the Chicago Show backers and management, as well as to voice an appreciation of the aviation enthusiasm of a lot of Chicagoans. Jack Vilas and his two co-captains, Jim Dunbar and Maynard Schryver, accomplished the rare achievement of pleasing both the customers and the exhibitors. Not one disgruntled word was uttered by the latter during the run of the show, which is 18 carat proof of this statement. It also proves, incidentally, that an air show

(*Concluded on page* 76)

Auction

by M. K. RAND

The British have been doing unusual things in aviation for a long time, so a wholesale airplane auction might be expected. No stunt, however, the plane sales went off in great shape.

NEVER let it be said that an Englishman gets in much of a rut. At least an air-minded Englishman. Not only do the British do unusual things with their airplanes, take unusual aerial photographs (American air-photographers *please* note!) and drink tea at approximately 4 p. m. daily, they think up novel ways of accomplishing what we Yanks consider drab routine. In other words, not many Americans would think of trying to sell their second-hand airplanes in any other way than by placing a classified advertisement in a magazine or two. Not so Johnny Bull; he concocted a perfectly swell (but oh so old) idea and, from last reports, POPULAR AVIATION's correspondent overseas tells us that England's first airplane auction was both a financial and an entertaining success.

There was nothing very complicated about lining up 24 used airplanes at the Hanworth Air Park near London and banging away with the auctioneer's gavel. The above photograph is proof of the affair's popularity.

A rather meaty catalogue was handed out. Listed were the 24 ships to be auctioned off as well as a few engines and instruments that also went under the hammer. A notice in the front of the book invited buyers to inspect the airplanes and their log books as well as take the ship for a trial spin—with a few reservations, of course.

On the inside front cover of the catalogue appeared the auction's "conditions of sale" which, because of their rather novel aspects, make rather interesting reading. It was first pointed out that the highest bidder would get the airplane, engine, drift indicator or what have you. In case of an argument, though, the auctioneer could put that particular item back up for resale if he so chose. In addition, the auctioneer took it upon himself to stop the bidding where and when he pleased.

Regarding the good old American "getting your money's worth," the air-auctioneers were cagey: "Each lot is on view for thorough examination and trial, and shall be at the purchaser's risk in all respects from the fall of the hammer, and shall be paid for in full, and taken away with all faults and errors of every description on the day of sale, and neither the Vendor nor the auctioneers shall be liable for any damage to the same, or loss from whatever cause arising. The Purchaser shall pay the usual hangarage charges after the Sale." Your tough luck if the engine dropped out, in other words.

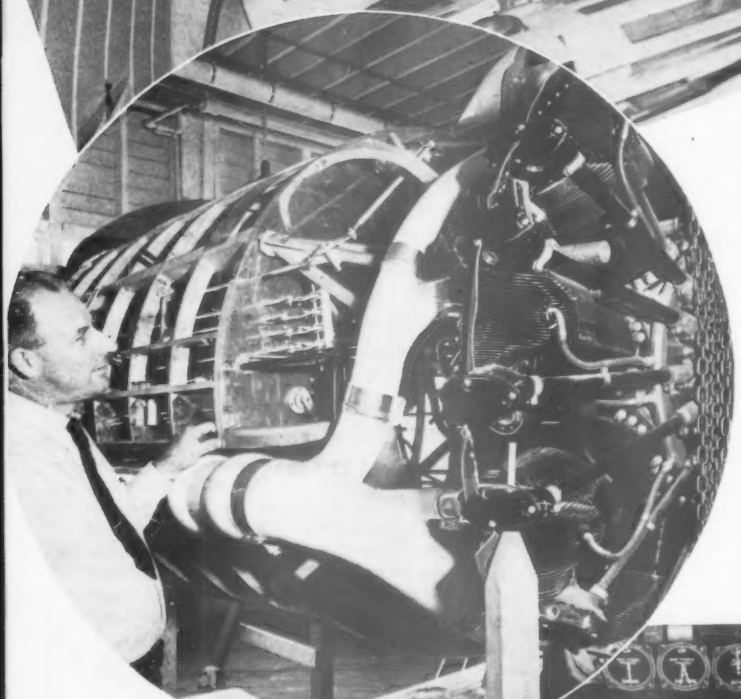
All in all, though, they had quite a choice batch of airplanes, etc., for sale. First airplane offered was a Hendy Heck which, for you P. A. readers who have slipped a little in your air lore, is a two-place low wing monoplane powered with a Gypsy engine. Listed with the ship's name and license letters (all ships were treated the same way) was the ship's total number of hours in the air, the engine's total hours and any special instruments or equipment. Also noted was the ship's status so far as the Certificate of Airworthiness was concerned.

The auction wasn't at all limited to any classification of aircraft. Every type of ship from a Carden Super-Drone powered with a converted Ford auto engine (the English use 'em, too) to a twin-engined DeHavilland airliner (there were four twin-engined ships on sale). So far as "brands" were concerned, DeHavilland stole the show. There were two *Major Moths*, three *Gypsy Moths*, two *Puss Moths*, a *Dragon*, *Dragonfly*, *Rapide*, *Leopard Moth* and *Fox Moth*—all of them DeHavilland. Then there were three Avro *Cadets*, an *Avian*, a B. A. *Swallow*, a Miles *Hawk*, a Monospar and a Cierva autogiro. Not to mention, of course, three very fine drift indicators of one type and 80 of another, one metal propeller, ten engines (many of them still crated) and a few other aeronautical odds and ends.

Tallyho!

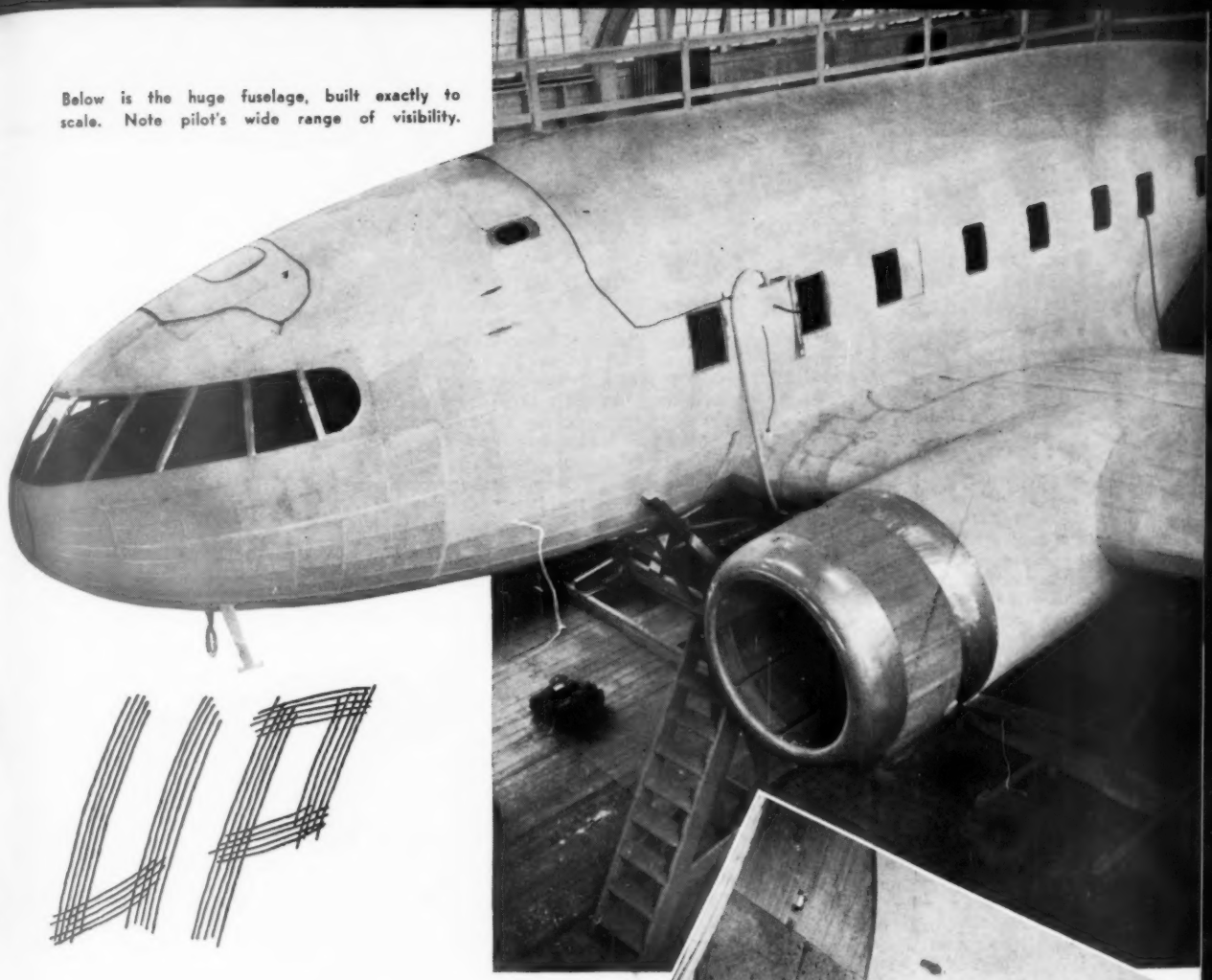
Airline engineers and officials give the mock-up thorough examinations before okaying construction of actual ship.

MOCK



Even instruments are simulated in the mock-up. Jimmy Doolittle (left) checks layout and controls.

Below is the huge fuselage, built exactly to scale. Note pilot's wide range of visibility.



MOCK-UP

Though the ship shown on these pages is a full-size dummy, it nonetheless is the new Boeing airliner in detail.

A MOCK-UP is a full-sized airplane built entirely of wood. It is not intended to fly; engineers and designers use the wooden dummy airplanes to arrange seats, compartments, controls, etc. before building the finished airplane. By doing this, manufacturers save a great deal of money; arranging and checking all seats and fixtures in a finished airplane almost always would prove a costly experiment.

The dummy shown on these pages, then, is a four-engined airliner complete even to door hinges—except that it will not fly. Any and all alterations can be made easily with a comparative lack of expense. The engineers shown here are checking even the minutest features of this new Boeing by having them installed exactly as they will be in the finished airliner. Though a mock-up would seem a bit unnecessary to the layman, to the manufacturer it represents partial insurance on a big investment. Only after every phase and feature of this mock-up has been okayed will the actual building begin.

Even the compartments (right) are laid out with great detail.

Below is an artist's conception of the new Boeing four-engined airliner as it will appear in flight.

The MAN UNDER THE HOOD

By D. W. W.*

BEST story of the month is the tale about the two young Army pilots from Langley Field. Each of them had about 100 hours on the Boeing *Flying Fortress* bombers (B-17s) which are at that station. These young men, because of their four-engined landplane experience, were considered ideal material for the four-engined era in transport . . . United Airlines talent scouts hired both the boys and started them toward the company offices at Chicago . . . At Washington a couple of Eastern Airlines claim jumpers got hold of the boys and did a bit of high pressure selling . . . Only one of the bright young men went on toward the west and United . . . The other succumbed to Capt. Eddie Rickenbacher's blandishments.

* * *

Seriously, the Army is greatly disturbed over the fact that about the time young pilots are checked off on the big new bombers they are grabbed by the airlines . . . This means there never are any well trained crews available for the machines . . . This very item was the chief reason for the change in regulations which allows reserve pilots to go back into active duty for three years with a substantial bonus at the end of that period . . . And the lack of trained personnel has resulted in raising the age limit from 30 to 35 for civilian trained pilots who wish to enter the Air Corps Reserve . . . Now is the time to get into the service, you civil pilots . . . The bars temporarily are down . . . Better take advantage of the situation.

* * *

We heard a prescription for air-sickness the other day . . . The Army's doctors have known for a long time that both air-sickness and sea sickness are caused by an unbalancing of the human body's alkaline level . . . Now the doctors say that the thing to do is to get a large paper bag, hold this over your face and breathe into it . . . You will begin breathing carbon-dioxide from your own lungs within a few seconds . . . And since carbon-dioxide creates carbonates this helps to get you back on the alkaline side.

And another item about the health situation for pilots is this: Your eyes will be better if you eat lots of carrots, spinach, butter, cheese . . . The reason being that these foods contain the important Vitamin A . . . This particular vitamin is essential in the production of visual purple which enables the eye to see . . . It is especially recommended to get a full ration of carrots and spinach if you are going to do any night flying . . .

*The author is one of the best-informed aviation men in the country, withholding his identity in order to maintain complete freedom of comment. —The Editors.

Another hostess item: We said last month that all the major airlines had dropped the marriage bar—that they would now hire girls they knew to be married as stewardesses . . . United Airlines protests that it has *NOT* dropped the non-married requirement . . . Transcontinental & Western Air, American Airlines among the larger companies, and several smaller lines, are ignoring this point . . . Anyway, United's protest reminds us of the operetta scene which ends with the question "What, never?" and the reply, "Well, hardly ever."

* * *

Although you'd never guess it from their pages, the aviation magazines and newspapers even in this country have a hard time keeping their pages free from censorship . . . At the International Air Show in Chicago they withstood another attempt to dictate what and how they should print aviation news . . . It was none of our business, of course, because POPULAR AVIATION's editors have given this writer carte blanche—but what happened was as follows:

The futile Aeronautical Chamber of Commerce called together representatives of Waco, Ryan, Piper *(Cub)*, Monocoupe, Lockheed, etc., and drummed up some support for a mass "cooperative move" on aviation publications . . . These manufacturers' representatives decided it was time to attempt to "draw up a code" for the publishers . . . They went into a huddle and agreed to the "code", then called in the publishers who, meanwhile, had learned of what was afoot and had held a conference themselves . . . POPULAR AVIATION's Swanee Taylor was chosen as the publishers' spokesman to tell the manufacturers they didn't know what they were asking, and that they apparently do not appreciate the swell cooperation they now get.

Of course, the publishers refused to agree to any code . . . And they balked completely when asked not to print photos or news concerning any experimental models . . . The censorship move collapsed then and there, so you'll continue to get your stuff hot off the griddle from all the aeronautical magazines . . . We thought you'd like this peek behind what appears to be a completely serene front . . .

* * *

Here are a few more facts from the airplane engine front . . . The new 1,500 h.p. Wright twin-row *Cyclones* which are going into Pan American Airways' new Boeing boats will be, in all probability, the most economical electric ignition engines ever built . . . Pan American's Chief Engineer, Andre Priester, is hoping to get a specific consumption of about .35 pounds per horsepower-hour from these motors . . .

In case you didn't know, this is nothing short of phenomenal . . . The average engine on the country's airlines burns from .48 pounds per horsepower-hour upwards . . . Pan American, because it makes a policy of using about 45 percent of full power for long range cruising, has been getting a little better than domestic lines . . . The story is that the Pratt & Whitney *Twin Wasps* on the Pacific route have been giving .42 pounds per horsepower-hour.

Diesel engines, which long have been considered the acme of efficiency, consume .38 pounds per horsepower-hour . . . Thus you can see the meaning of an electric ignition engine which burns only .35 pounds . . . And maybe you've heard a lot about the German Diesel airplane motors and how wonderful they are . . . It's a lot of bunk . . . One of the pilots of the two German seaplanes that made experimental flights across the Atlantic last summer told this writer that the Diesels are not so hot . . . Asked why they were used instead of electric ignition engines, the German shrugged and said: "It's something the government wants. So we're saddled with it."

* * *

Don't expect to see any four-engined airliners in service on U. S. lines before next October. The first of the Boeing 307 machines ordered by TWA will be delivered about August 1 . . . Then there's the job of training crews and getting enough machines to start a service . . . The way things look now it will be next spring, but Boeing is supposed to be doing wonders in production . . . The first Douglas DC-4 may be flying by March 15, but that plane is strictly an experimental machine and there will probably be a year's flying with it before production orders go in . . . That means no DC-4's until 1940.

* * *

In spite of all the hot air passed out about the Army's super-wonderful substratosphere Lockheed, the pilots who are most familiar with it make the least claims for it . . . Maj. Carl Greene from Wright Field who engineered the sealed and supercharged cabin told your man under the hood that the plane leaks badly, that the pilot visibility is terrible and that the heavy plexiglass windows bulge under the internal pressure . . . He says they have had all sorts of difficulty in maintaining a constant pressure inside and that every time they've gone up to a really high altitude those aboard have suffered ill effects of one sort or another.

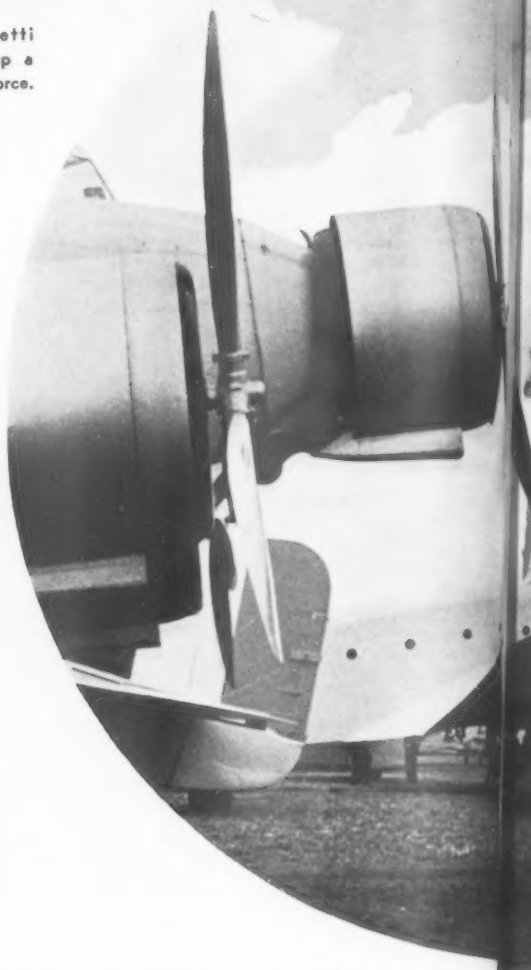
The boys who assert the Army now knows all that is necessary about substratosphere flying as a result of experiments with this plane are somewhat nonplussed by the pilots' attitude . . . These boasters however have never had to land the ship with only a tiny crack of a front window out of which to see . . . When the nose comes up in the flare-off, the pilots cannot see anything at all . . .

(*Concluded on page* 88)

FOR AULD LANG SYNE...

Here's a belated salute to the "grand old girls of aviation," the famed Curtiss "Jennies".

Huge Savoia-Marchetti S-81's (right) make up a large part of Italy's air force.



ALESSANDRO MARCHETTI *Says*

"AVIATION Is My Life..."

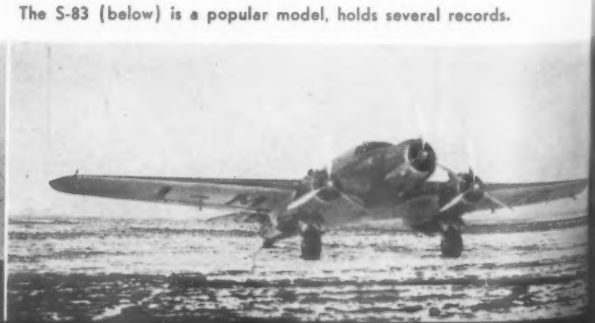
This famous Italian designer and engineer has written his story especially for POPULAR AVIATION.

Compare Marchetti's original airplane (above) to the modern tri-motored S-81 bomber below. Savoia-Marchetti bombers as well as commercial models are probably the most widely-used Italian aircraft today. Note the glass bombers' enclosure.

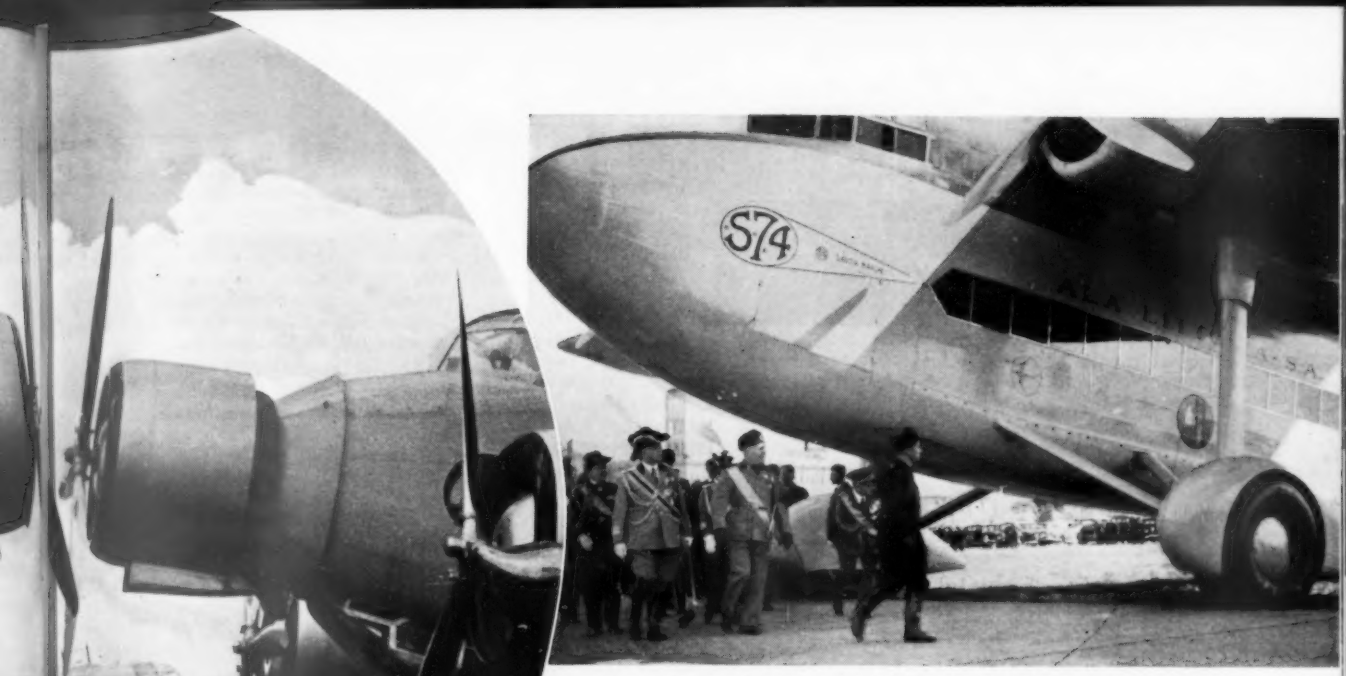
IT was my good fortune to take up aviation at the very beginning of my professional life, when real interest in flying was first being shown in Europe. From that time to the present day I have planned and designed unflaggingly and have come to see myself among the principal figures in world aviation. Since I have witnessed the progress of aviation during 25 years, I shall give a brief resume of my own development which I proudly contributed to aeronautics.

To start at the beginning, I turn back to the year 1908, when the French academicians, after profound mathematical calculations, declared that flight by engine power was an unrealizable Utopia of mechanical science. At that time aviation was not considered, unfortunately, a rational line of endeavor but as something based on natural instinct and fed by poetry and daring. Nevertheless, in 1908 many ardent sportsmen and technicians who nursed within themselves this innate germ of aviation were anxioulsy awaiting the almost miraculous event which soon took place in America. The two Wright brothers, in a rudimental plane powered by a single engine, made several modest but genuine flights—in spite of all theories.

We who experienced the exaltation of that moment when the most fascinating of all human achievement was realized were fortunate indeed. I was at that time a keen sportsman; but I was also instinctively a mechanic. I was in my last year at the School of Engineering in Rome, and the flight made by the two Americans disturbed my sleep. To me



The S-83 (below) is a popular model, holds several records.



Premier Mussolini and staff inspect a giant S-74 four-engined airliner.

no study seemed more interesting than that of combining academic learning and the well-nigh fantastic technic of flying, with the purpose of building a machine of my own—a subject entirely ignored in the college curriculum of the time. Thus in 1908 I began my first study of the flying machine and pursued it as a secret love; for a budding engineer was expected to turn himself to more practical work than this unmentionable subject, which involved ideality actually dwelling in the air, together with the risk taken by a tight-rope dance—and, in addition, it was a very expensive hobby. But I was encouraged in that same year by the first European aeronautical studies of Farman, Bleriot, Voisin and Levasseur in France, where there has always been an atmosphere of intense industrial interest and ample enthusiasm.

It was by chance that I came to construct my first machine and my career was chosen. A friend of mine, equally interested in sport, happened to get one of the first automobile engines built lighter for aviation use by the German company, Argus. It was about 50 h.p. and quite a good engine, but heavy and water-cooled. We went into a partnership of the most light-hearted yet faithful kind. I was to supply the airplane, he the engine, and we were to fly together.

My first airplane was accordingly built in Rome, where the environment was magnificent in every way except in the matter of encouraging industrial development. It was constructed with many difficulties in a modest sawmill where woodwork and locks were made, and finished late in 1909. Technically the machine was a two-seater biplane and had entirely original lines and wing structure. The qualifications sought (which reflect the age) were about 25 miles an hour for the lowest speed of take-off and landing, and an adequate command of equilibrium and general efficiency. With these conditions I felt that the danger of unbalance and loss of control in the hands of an absolutely inexperienced pilot such as I, had been reduced to a minimum. The success of my venture as a constructor and pilot lay in the thoroughness with which I made my plans and carried them out.

In the maturity of today, I cannot imagine a more dangerous combination than a newly designed plane flown by a constructor-pilot who is as new in technic and experience as the plane.

Those of us who, in the early stage of aviation had such an experience and are still here to tell about it, can be numbered on one's fingers. Early in 1910 I flew a great deal with this machine, going slowly and with great caution and diffidence. The craft fulfilled so faithfully my expectations, however, that as I became accustomed to it I grew so confident that this very confidence was the greatest threat to my safety. Looking back today on the sensations I had while flying then, and recalling certain moments when gliding slowly with my engine shut off in that traquility which is the ideal of flight, I think that I often must have come close to that fatal trap, the side-slip.

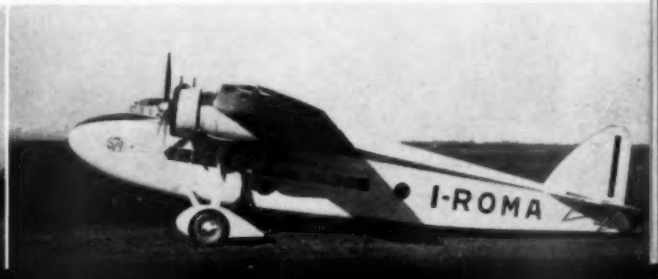
It was my fate one day, after an exhibition of elementary stunt flying in the presence of friends, to make a brilliant but too-long landing and strike a fence I had not seen. My plane was practically destroyed. I had christened it *The Chimera,* and its name had foretold its destiny.

I had three experiences in those early days which remain firmly fixed in my memory. The first was when with a clutch at my heart I found myself in flight for the first time while I was trying a race on the ground—an emotion which cannot be imparted to anyone except to a few of my colleagues who have had similar experiences.

The second moment I recall was when

Below is one of the latest Savoia-Marchetti tri-motored airliners.

Four 700 h.p. engines power this 27-passenger S-74.



Marchetti's M.V.T. (left) was the second airplane he built. It was all-metal and had almost-phenomenal performance for its day.

I attempted for the first time to make a flight around the field, being then expert enough in taking-off, in making short hops in a straight line, and in landing. Through excessive caution I made an error that might have been fatal. To prevent the plane from inclining toward the center of a turn which, in my ignorance I thought was the greatest danger, I thrust the rudder in position for a turn and at the same time held the biplane in a horizontal position. As the plane did not bank, it skidded obliquely without making the turn and carried me completely away from the field. I found myself over wooded ground where it was impossible to land.

An infinity of new and startling sensations overwhelmed me, among which the most intense was of not being able to turn and of being hurled forward in a straight line with no prospect of returning or landing and of being sure to end disastrously when the gasoline was exhausted. Through these eternal moments of indescribable anguish, while my hair stood on end and I gritted my teeth, the plane over which I had no control rose to a height that to my unaccustomed eyes seemed abysmal. Fortunately the gasoline did not give out. I desperately held the maneuver I had mistakenly made for a turn, though I noticed only a very slow change in direction. After an extremely long flight, I was brought back toward the field which seemed so small and faraway that I lost all hope of reaching it with my plane out of control. By luck alone I finished my flight safely.

My third memorable experience, which finished *The Chimera* cycle, was when the biplane rolled over me, cracking up over the fence after what proved to be its last flight. I got up unhurt and at the sight of the grotesquely twisted framework, at the sight of my sympathetic friend, and gazing at the magnificent May day with all the fields in bloom, the happiness of being alive after such a close escape made me burst into a fit of uncontrollable laughter.

I promised my friends not to fly again and kept my word until the World War. Thus, I took aviation for pleasure, was immersed in it for a few months, and then sadly had to give it up, since it cost far too much for a private individual.

I remained a nostalgic, a Platonic student, completely won to this magnificent art which waited more propitious times. With the outbreak of the World War, Italy's great airplane industry really began. Being an officer of aviation, I was assigned to the technical department of the Vickers-Terni Company of La Spezia, which had established airplane departments. Here, as in many other Italian firms created by the force of circumstance, foreign machines of recognized types were constructed for the immediate needs of the war. France had lavished enormous sums on aviation for sport and already had industries and types of planes that showed definite progress. France's greatest customer proved to be Italy, with its still-young industry.

At the Vickers-Terni I planned an all-metal pursuit plane, the "M.V.T." (Marchetti-Vickers-Terni), which soon became very well known because of its type of construction and because of its flying qualities. It was built entirely of steel, and because of this I was confronted with numerous construction difficulties and had also to spend much time making proper tools. The lack of suitable material in war time obliged me, for example, to make the wing beams from gun carriages of the French Deport 75 mm. cannon that were also constructed at Vickers-Terni.

This plane did more than 150 miles an hour with 225 horsepower, (extraordinary results for that time) and rose to 16,000 feet in 17 minutes with 506 lbs. of useful load. It was so far superior to all the other types used by the Allied armies that plans were made to turn out similar planes in large quantity. The plane was finished in September, 1917, and established a world's speed record which could not be internationally clocked because of the War. Just as large scale production was about to be begun, the Armistice was signed.

The "M.V.T." deserves to be remembered because it was the most advanced development at that time in aeronautical construction. Several copies were made, and then all initiative was chocked in the post-war period.

An important lesson was learned from the "M.V.T." about the relative merits of constructing with wood or with metal. After this experience I was absolutely convinced of the superiority of the wood construction, at least for military planes —and I certainly cannot be charged with incomplete knowledge of the material, since my first professional success was made with a metal plane.

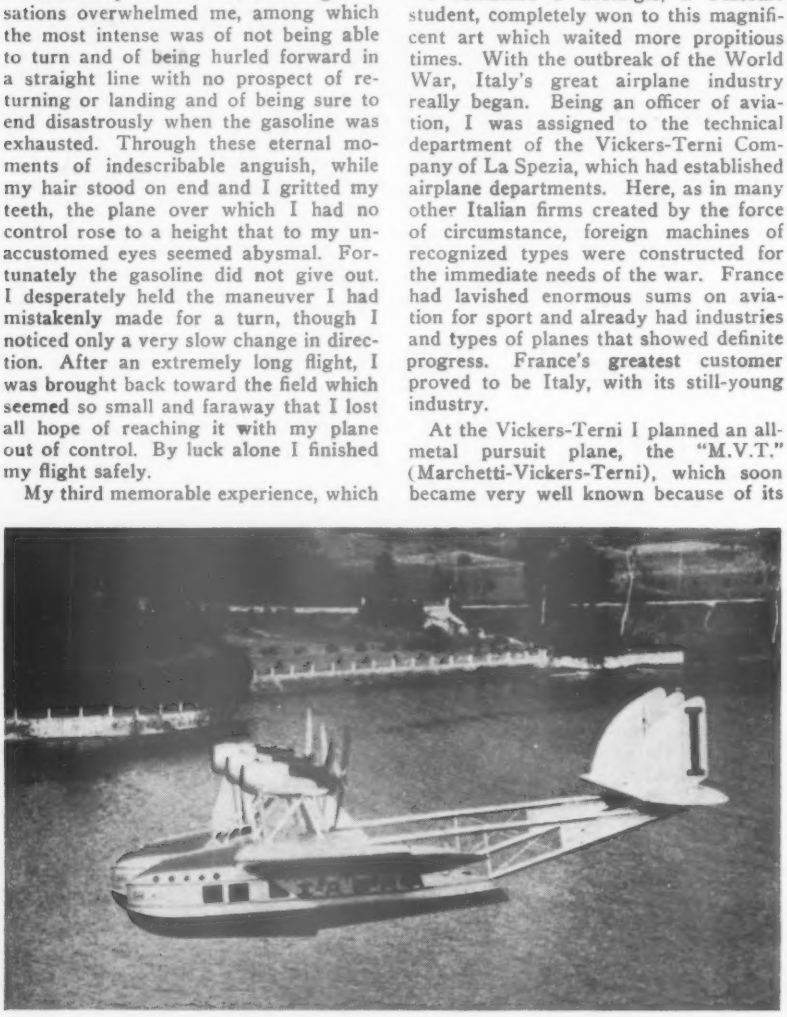
Successive studies have confirmed me in the conviction that wood is preferable to metal whenever rapidity, economy and simplicity in production is required, together with easiness of repair.

The post-war period saw a stagnation in the progress of aviation. A quantity of left-over machines and useless engines filled the hangars. Absolutely no funds were to be had for new construction. Lacking construction activity, aviation was regaled to the study where much thought was given to the lessons of the past war and where the following principles were universally acknowledged:

1. By adapting machines built for sport to war serivce, hybrid machines had been created with results far different from those which could be obtained from machines built expressly for military service.
2. Since the machines built up to that time had the above disadvantage, it was impossible to judge correctly their contribution in the last war.
3. By studying the proper machines it would have been possible to have wars between aerial armies with results in no way comparable to those actually obtained. (The champion of this new well-known thesis was the late Colonel Douhet.)

During this period when past gains were being summed up, I began making

(*Continued on page* 82)



Americans best recall Marchetti for his famed twin-hull flying boats. The S-66 above closely resembles the type which Balbo flew to Chicago's 1933 World's Fair.

FIRST NATIONAL AIR BOARD *AWARD*

DR. ALEXANDER KLEMIN, Chairman

NOT long ago POPULAR AVIATION *announced, through its National Air Board, the establishment of an annual award to be presented to the person voted by the Board as the one having done the greatest service to aviation in general along the lines of safety. Here, then, is the first man to receive the award: Jack Franklin, TWA communications engineer, who was largely responsible for the rotatable loop antenna now in standard airline use.*

Jack Franklin is shown above receiving his $250 check from Max Karant, POPULAR AVIATION associate editor. Award was for the loop antenna near Franklin's head.

THE twenty-first meeting of the Air Board was entirely devoted to the consideration of the Safety Award announced some time ago. Readers will remember that this award, to be made annually "For the most important contribution by device, invention or method to the safety of aviation," comprises a cash prize of $250 and a bronze plaque. The award was made possible by the generosity of the publishers of POPULAR AVIATION. Suggestions regarding contributions to safety had been sought far and wide, with members of the Board themselves sponsoring a number of developments. The ground work for this last meeting had been carefully prepared, and a system of discussion and voting by figure of merit prepared for well ahead of the meeting.

Thirteen Suggestions.

Thirteen definite suggestions, made by well-informed sponsors, had been received. They were:

1. Static shielded rotatable loop antenna.
2. Viele water-locking valve to prevent water from entering fuel tanks.
3. Airport traffic control system.
4. Simultaneous voice and radio range broadcast.
5. Link trainer.
6. Airway traffic rules.
7. Development of NA-16-1P general purpose trainers.
8. De-icing equipment.
9. Developments in instrument landing equipment.
10. The Vertaplane.
11. Installation of radio direction finders.
12. The tricycle landing gear.
13. The Constantin Girouette.

Earl F. Ward, Honorable Mention

The procedure adopted was for some member of the Board to present fully the merits of a particular development. Such presentation was followed by general and careful discussion.

1. Rotatable Shielded Loop Antenna.

D. W. Tomlinson and A. Raymond Brooks jointly sponsored this development. Mr. Tomlinson made a striking presentation. The utilization of the fixed radio loop is, of course, very old in the art. The rotatable loop is a good deal more recent. Simple in principle, the device is a godsend in practical air transport operation. The flyer can set the loop to receive the maximum intensity or best reception from any broadcasting station, get bearings on a number of points and, with the help of a suitable radio map, check his position correctly within 30 seconds. In the recent adventure (not accident) where a plane was lost for several hours in a snow storm, the loop finally did enable the pilot to get his bearings on Floyd Bennett Field, and to pull himself out of a bad jam. A radio range beam may have a "kink" in it just when its services are most needed. The magic loop then makes use of any other station and defeats the "kink." Of course, the electrostatic ring shielding is a great help; without it static would cause insuperable difficulties. Just half an inch split in the shield is all that is necessary to allow the radio waves full action on the copper loop proper. Captain Depew pointed out that the rotatable loop had long been known on ships at sea, and in connection with radio compasses, that a number of aircraft radio companies had experimented and developed the rotatable loop. Perhaps, Depew said, no award could be made on a device in whose development so many individuals and organizations had been concerned. In the opinion of Captain Brooks, however, one individual had done most in the final perfection of the rotatable loop, in its installation on the airlines and in its energetic employment in the face of scoffing and scepticism. This individual was Jack

Gerard P. Herrick, Honorable Mention

Franklin, superintendent of communications of TWA. The give and take of conversation strongly confirmed this view.

2. Viele Water-Locking Valve.

The Viele water-locking valve, a simple yet effective device based on the fact that water has a higher specific gravity than gasoline, has played a very useful part in increasing safety and has been installed in a number of ships. The sponsor of the Viele valve was Jerome Lederer, chief engineer of Aero Insurance Underwriters, whose opinions in the matter of aviation safety are held in the greatest respect. Still, members felt that this was a comparatively minor device; that there were other devices of similar characteristics not perhaps of as great a merit, and it appeared that no matter what strainers or valves were used in the gasoline systems, sampling of the fuel for water content still had to be made at intervals.

3. Airport Traffic Control System.

The Board never loses an opportunity to criticise the Air Traffic regulations as being unduly complex. But inconsistently or not, the Board has great admiration for the Air Traffic Control system set up at our major airports. Without such control, how could a number of planes land in rapid succession at an airport, particularly under conditions of bad visibility? The airlines themselves actually pioneered such a system several years ago. But it was Earl Ward with the Bureau of Air Commerce back of him who had perfected the rules, put them into application and made them stick. Mr. Brooks made this an excellent case.

4. Simultaneous Voice and Radio Range Broadcast.

Captain Brooks is one of the best-informed men on aircraft communications, and no one could have better brought out the utility of this particular aid to navigation. A man listening to the radio range beacons often loses his position when the weather broadcast interrupts his reception of beam signals and such interruption might be a very serious matter. With the development of simultaneous transmission and reception of radio range and voice broadcast, the situation has changed very much for the better. The four radio towers at Newark airport, for example, now are supplemented by a fifth for voice broadcast. The pilot can listen to the range beacon, or switch over to the weather broadcasting by manipulating a switch. Or he can arrange for simultaneous reception, with the voice imparting to the beacon signals only slight confusion. It appeared from the discussion that W. E. Jackson, radio engineer of the Bureau of Air Commerce, had striven mightily in the perfection of this device, and just as energetically in securing its adoption.

5. Link Trainer.

Colonel Kerwood made a strong plea for the Link trainer, citing its real benefits in simplifying flight training, particularly as an introduction to blind flying. Mr. Tomlinson said that TWA used the Link trainer continuously in checking up on the ability of pilots to meet such navi-

(*Concluded on page 72*)

Remember the Model "B" Wright?

tion in the camber near the wing tips. Wing warping preceded ailerons on several early ships such as the Bleriot, Hanriot and Plaubel. However, this practice racked the ribs.

One of the unique provisions of the Wright patent was the combined action of the wing warp and vertical rudder,

These rare flight photos of Model "B" Wright ships clearly show their main features and outlines.

ONE of the first planes, if not the first, to be offered on the American market was the old model "B" Wright, manufactured by the Wright Brothers, Dayton, Ohio.

This oldtimer was prominent at nearly all of the early airmeets during the years 1908-1910, with its two propellers clattering away overhead and grinding out the hours—at that time averaging one buck per minute or even better in some pay streaks.

Model "B" was distinguished by being the first "headless" model, that is, all control surfaces were in the rear, the front elevator-stabilizer of the previous Model "A" being eliminated.

Two pusher propellers were driven through chains and speed reducing sprockets so that they turned over at about 400 r.p.m. and in consequence were highly efficient at this extremely low speed even though the blade sections were not notable for their airfoil characteristics.

As most of you probably know, all of the control surfaces were warped or flexed instead of hinged. Lateral control was had by pulling down the trailing edges of the wings at right or left, bending the ribs and thus producing a variation in the camber near the wing tips. Wing warping preceded ailerons on several early ships such as the Bleriot, Hanriot and Plaubel. However, this practice racked the ribs.

One of the unique provisions of the Wright patent was the combined action of the wing warp and vertical rudder, the system being so arranged that the rudder was turned to compensate for the increased drag of the low aileron, thus eliminating yaw that would otherwise have resulted from the unequal drag at the wing tips.

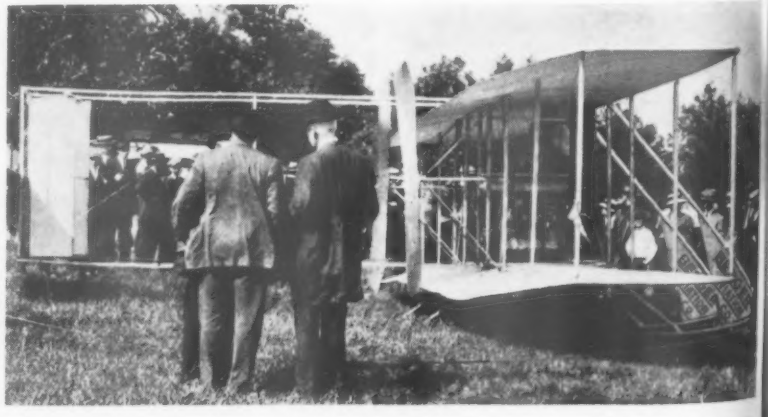
Fully loaded, the Model "B" weighed approximately 1,100 pounds and had a wing area of 440 square feet so that the total wing loading was about four pounds per square foot. This explained the surprisingly quick take-off, the short run and the low landing speed. Her top speed, under the best conditions averaged from 45 to 48 miles per hour while she landed at little better than a brisk trot.

A sharp quick roll of about 200 feet, under the urge of her twin propellers, kicked her well up into the air. The rather primitive landing-gear and the state of the fields at that time, made such take-offs almost imperative.

On the other hand, the exceedingly low wing loading made her the victim of every wind gust that crossed her path and she responded to rough weather to an extent beyond the comprehension of the present generation who are accustomed to fly ships loaded to 15 pounds

(*Concluded on page 81*)

Below is a rare and interesting close-up of one of the early Wright ships. The two heavy propellers were driven by chains running from the single engine.



Engineers attach the woolen streamers to the ship's wing prior to the test flights. These record the air flow.

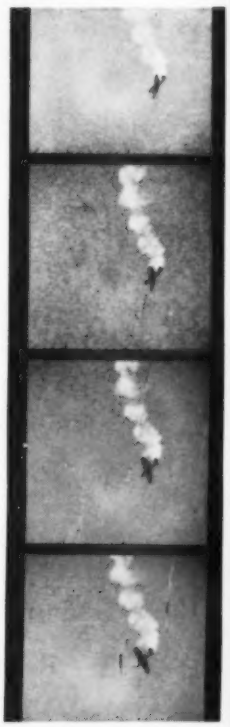
A small parachute in a new ship's tail will pull that plane out of a flat spin.

SCIENCE in AVIATION

ONE of the most interesting phases of modern aviation is in experiments. With modern science playing a leading role, many hitherto unknown and astonishing facts have been uncovered by the meticulous scientist that have placed aviation on an entirely new, much more firm, basis than it has ever been. Though these elaborate experiments basically are pretty much alike, each nation nevertheless goes about its work in this field in a different way. The methods illustrated on this page are German, and consequently minutely scientific.

Whereas American engineers employ the world's largest wind tunnels in testing various designs and inventions, the engineers shown here prefer the flight tests. The woolen streamers accurately show air flow over a wing. A smoke pot in a spinning airplane is recorded on movie film as a permanent, accurate record. Results obtained, however, are largely alike.

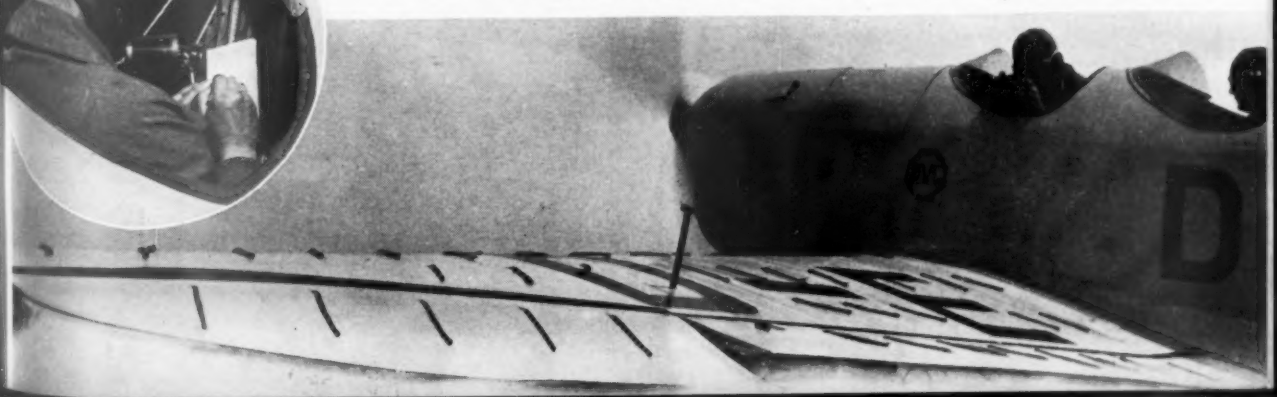
The photographs (right) show the action of the woolen streamers on a biplane during a normal, level flight.



The spinning airplane (right) has its actions and track recorded by a long-range movie camera. A smoke pot leaves an easily-seen trail.

The test pilot (below) both photographs and compiles data concerning the performance of the ship he flies.

The low-winged sport ship below is being tested for wing and control characteristics. In this ship, an engineer is carried who makes both observations and photos.



Rx Every 45

1 In the depth perception test the pilot lines up two vertical bars.

2 This instrument is the phorometer and is used to check eye muscles.

3 In the hearing test, Pilot Woolweaver must hear the watch easily.

THE photographs and data on this and the opposite page are a lesson the public has needed for a long time. They concern that much-cussed and discussed God-of-the-Heavens, the airline pilot. It is that "God-of-the-Heavens," status that makes this lesson necessary.

Ask an average person "what kind of a fellow is an airline pilot?" and you'll probably hear various hazy tales ranging from the super-human rating to a drunken bum. Practically none of these fantastic conceptions are true. The photographs on these pages prove that.

An airline pilot is a human being like you or me who simply takes care of himself and is taken care of like we should be. Consequently, though an airline pilot is no more "super-human" than anyone else, he is in better shape physically and mentally than you and I—providing, of course, that you and I are much like Joe Doakes and Mary Roe.

The only "super" feature about the average airline pilot is that he has put in hard years (many of them discouraging) working his way step by step to where he is today. No airline will accept even a co-pilot who has less than 700 hours of flying to his credit. That means he must have flown the equivalent of more than *two solid years of eight-hour days,* in order to get the lowest flying job on an airline. Even then, airlines prefer men with 1,000 hours for their co-pilot jobs.

If you are a perfectly normal person you can successfully pass the tests First Pilot Gerald Woolweaver of American Airlines is shown going through in the accompanying pictures. Perhaps as thorough a physical examination as can be devised, Pilot Woolweaver and his brother airline pilots throughout the country must go through this routine once every 45 days. The doctor shown examining Pilot Woolweaver is Dr. Herbert F. Fenwick, Bureau of Air Commerce medical examiner in the Chicago area. Some airlines, though, have their own physicians examine pilots in addition to the federal examination.

In many cases the Bureau of Air Commerce examiner is an experienced pilot himself. Dr. Fenwick, for instance, is an Army airman and also holds a commercial transport license. In addition to being medical men, then, these physicians know aviation as well. They know what to look for; points that are not necessarily included in the government's form medical requirements.

It is probably well known to the layman that the most important check-point on an airline pilot is his eyes. Under ordinary conditions there can be no allowance made for an airline pilot's eyes; they must be perfect—20/20. Not only must his visual acuity and depth perception be normal; the airline pilot's eye muscles must be checked for correct balance, lest one become tired more rapidly than the other.

Ears, heart, lungs—all are of vital importance when piloting a giant airliner, and all are minutely checked every 45 days. The slightest deviation in the pilot's condition will show up immediately under the experienced eyes of the medical examiner. Lack of physical care of himself on the part of an airliner pilot might easily mean the temporary or permanent suspension of his license and the subsequent loss of his job.

Knowing these facts, then, it can readily be seen where the unfounded opinions of the general public are so far out of line. He is no super-man; the airline pilot is a normal individual who must keep himself that way. In his private life he probably has a home and family to go to after he has flown his run. It

4 Dr. Fenwick checks each pilot's color vision with specially prepared charts.

5 The pilot's reclining blood pressure (the Schneider test) is important.

Days

To the layman let this and the opposite page be an object lesson in good health. Probably in no other field of endeavor is a man's physical condition checked so carefully and so frequently as that of the airline pilot. On these pages, then, a cameraman has followed Pilot Gerald Woolweaver through each stage of his periodic examination.

is quite possible that the man sitting next to you in the movie the other night had, just a few hours before, been guiding a huge airliner through a rough storm high above the earth.

As to that "drunken bum" angle, far too many people insist on dwelling on that theory. A "drunken bum" would be in just that status physically. He probably wouldn't get by the preliminary examination given by the medical examiner. Liquor, taken in excess, takes telling toll on any man's condition. The misconception, so far as airline pilots are concerned, probably was founded on the pictures our fathers and mothers painted of the early dare-devil barnstorming pilots. Today, however, it will be found that a great many pilots (like Pilot Woolweaver) refuse liquor of any kind. Others admittedly do drink, like you or me. But the airline pilot must constantly be in shape for "every 45 days".

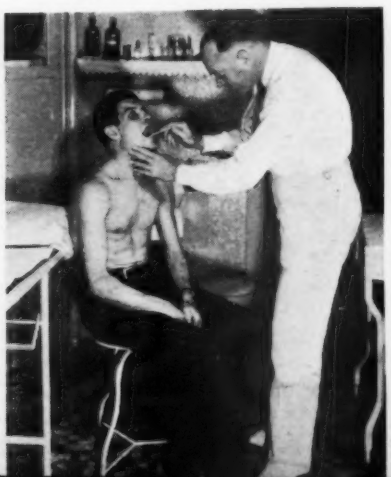
So, the next time you ride behind Pilot Woolweaver or one of his brother airmen, remember that no more fit man ever flew that giant airliner.

END

9 His gruelling physical test over, Pilot Woolweaver is checked even further by thorough airline examiners for proficiency in piloting as well as navigation.

6 After timing the pilot's steps on the stool, the examiner checks his pulse.

7 Tonsils, teeth and throat are carefully checked for possible infection.



8 Finding Pilot Woolweaver fit, Dr. Fenwick issues an approved certificate.

FLYING TRICYCLE

Its dangling, stork-like wheels giving it an awkward appearance, this Stearman-Hammond cruises past Frisco's new island airport.

Above is the present Taylor factory at Alliance, Ohio.

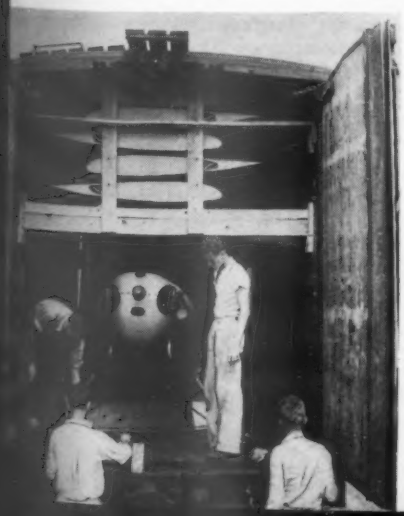
Putt-Putt Potentate

by GEORGE R. REISS

Pile all of C. G. Taylor's accomplishments in one heap and you have thousands of air-minded Americans who are flying today, thanks to him.

C. G. Taylor

The box car below has been especially adapted for the shipment of airplanes.



MEET, ladies and gentlemen, the fellow who has done more than his bit to make America air-minded. Meet the fellow who probably has done more than any other to put more Americans at the controls of flying airplanes; who has done more than any other to take the mystery, high cost, hard work, and danger out of flying; who has done so much to make it a reasonably safe, reasonably economical, and reasonably easy sport.

He is the fellow whose name is borne by more airplanes than any other living man. He is the fellow who is responsible for most of those little putt-a-putts you see soaring (on three gallons of gasoline per hour) so gracefully and easily of a Sunday afternoon around the smaller airports and landing fields—the Taylorcrafts and *Cubs*.

He is the fellow who is responsible for more of those 50,000 flying Americans—the students and the full-fledged pilots—than any other, for more of them learned or are learning on planes he designed than on any other type. And all that with only an aeronautical training in the "School of Hard Knocks" and a degree from the "College of Practical Experience."

He is C. Gilbert Taylor, designer of both the Taylorcraft and the *Cub* who now is president of the Taylor-Young Airplane Company of Alliance, Ohio, builders of the rapidly-growing Taylorcraft fleet.

It might be best to explain here and now that Mr. C. Gilbert Taylor's aeronautical achievements have so brought him into the foreground of recent years that we, the flying public, are entitled to pull back the curtain for a peek into his background. Just a hurried, quick peek.

Gilbert Taylor is a tall, slim, nervous-appearing man who walks with a painful and noticeable limp. He is modest and inconspicuous around the Taylor-

craft factory, yet he is the boss and everyone knows it.

One might say that his interest in things aeronautical began at the beginning. At least, almost at the beginning. For, when Gilbert Taylor was only 11 years old—29 years ago—he began building his first airplane, a flimsy, frail thing of bamboo and canvas, at his home in Rochester, N. Y. It wasn't exactly a conspicuous success. In fact, it was a more conspicuous failure. It wouldn't even fly. But then—even the most caustic critics admit this—it did look something like an airplane, or rather what laughingly passed as an airplane in those good old dodo days of 1909.

With that crude old ship grew young Gilbert's interest and determination that some day he would build a really successful airplane—an airplane that would bear his name. And on that determination, and a lot of good flying characteristics, have been built some 2,000 airplanes bearing Taylor's name.

Along about that time, young Gilbert Taylor was stricken with his greatest handicap—infantile paralysis—but his interest in aeronautics did not wane, even the cruelest of the small boys—taunted him with:

"Now, how are you going to fly? Who ever heard of a flyer who couldn't even walk."

"I'll fly," retorted young Taylor, biting his lips under the pain of the disease and the crueler pain of the taunts. "I'll fly some day, and I'll build airplanes some day and I'll make you eat those words."

Remember, that was in the days before the U. S. Bureau of Air Commerce, and its regulations.

Young Taylor recovered, the disease leaving him only that limp, and he and his father (a tool and die maker) worked many hours during evenings to enable the boy to carry on his experiments with light airplanes. When he was 19 he had his first airplane ride and immediately became obsessed with the idea of flying himself. But he was not yet ready. He continued working with his experiments.

In 1925, Taylor bought an old Curtiss *Jenny*. Now a *Jenny* was a good-enough ship—back in 1917. But by 1925 standards she wasn't so hot. By 1925, folks were thinking of air speeds in terms of 100, 110, 125 m.p.h., instead of 60 or 65; they were thinking of bigger loads, longer cruising ranges, quicker take-offs.

Taylor, looking over the old ship, announced:

"I can take this ship, rebuild it with little cost, give it a lot more speed and more miles per gallon, give it a faster take-off, slower landing speed, make it carry a bigger load—and make it safer."

He took the ship into his barn, rebuilt it—and found it a very superior *Jenny* indeed. For months he barnstormed with the plane, collecting $5 or $10 a ride—and a lot of takers. But barnstorming wasn't for Gilbert Taylor. His real love was building airplanes. So he and his brother, Gordon, began building a two-place side-

(*Concluded on page* 92)

Our Front Cover: the Taylorcraft

This lightplane on floats makes an ideal ship for the casual sportsman-pilot.

THE striking flight photograph on the front cover was made off New York's Manhattan island by Hans Groenhoff, prominent aerial photographer. The flight was made particularly for photographic purposes, with a Kodachrome flight shot for POPULAR AVIATION the primary objective.

A lightplane on floats, like the Taylorcraft on the cover and above, is one of the most fascinating sports today. Regrettably, there is far less of this marine flying being done than should be. Main reason, probably, is the steep price of a pair of floats ($595). Far more sport planes in the United States should have a set of floats in addition to wheels. "Float-flying," in addition to being a great sport, has a greater safety factor in its favor. The Taylorcraft shown here, for instance, could safely make a forced landing anywhere and under practically any conditions. Top speed of this ship on floats is about 87 m.p.h.

Aeronautical Odds and Ends

CARROTS and spinach should have a prominent place in the diet of pilots, according to Col. Arnold D. Tuttle, medical director of United Air Lines and former commandant of the Army's school of aviation medicine at Randolph Field, Texas, who recently addressed the American Association for the Advancement of Sciences at Indianapolis.

These foods are rich in Vitamin A, which is essential to good eyesight. "The phototropic substance which enables us to see light is the visual purple deposited in the retina of the eye," Colonel Tuttle explained. "For its regeneration, this visual purple needs Vitamin A. In fact, without Vitamin A, it is probable that sight of any kind would be impossible."

* * *

FOUR foreign governments have promised to send airmen and aircraft to the Eight Annual National Air Carnival to be staged at Birmingham, Alabama, municipal airport June 4 and 5. According to Steadham Acker, Birmingham airport manager and general chairman of the carnival, writes that his show drew 150,000 persons in one day last year. Mr. Acker also points out that the Birmingham show is the only free major air meet held annually in the United States.

The Birmingham show is somewhat unique in that the public is admitted free of charge, yet Birmingham taxpayers or any civic organization do not have to foot the bills.

AN unusual test was run on a Bristol *Pegasus* engine in Great Britain recently in an effort to assure Bristol engineers that that engine would stand up under tropical rainstorms. A large spray nozzle of the "watering can" type was erected in front of the engine which had been mounted on a hangar test stand. After being fitted with a propeller, the engine was started and the water turned on.

With water flooding over it at the rate of 120 gallons per hour, the engine ran smoothly and shows no signs of trouble over extensive periods.

* * *

THE huge three-bladed propellers installed on Imperial Airways' Empire flying boats (*Canopus, Centaurus, Cambria,* etc.), are so finely balanced that they are worthy of mention. Built by a British licensee of an American propeller manufacturer, the boats' propellers are 13 feet in diameter and weigh 360 lbs. each.

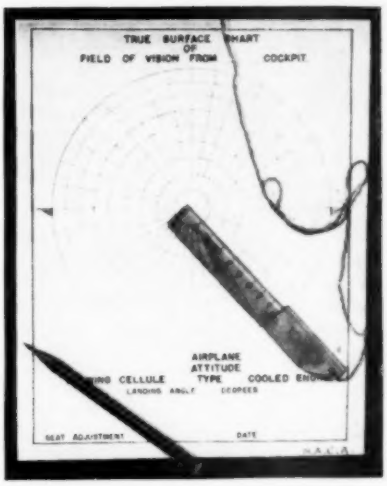
Despite this enormous size, however, British engineers have found that they are so finely balanced that the weight of one cigarette paper resting on one of the blades is sufficient to cause the whole propeller to start rotating.

According to Imperial Airways engineers, an instrument is used in the manufacture of these blades that can measure accurately to one ten-thousandth of an inch. Instruments of this extreme delicacy must be housed in a special air-conditioned chamber with double glass walls.

Air Visigonometry

by F. F. BLAGG

A new method of measuring the pilot's angle of vision as devised by the National Advisory Committee on Aeronautics, Washington, D. C.



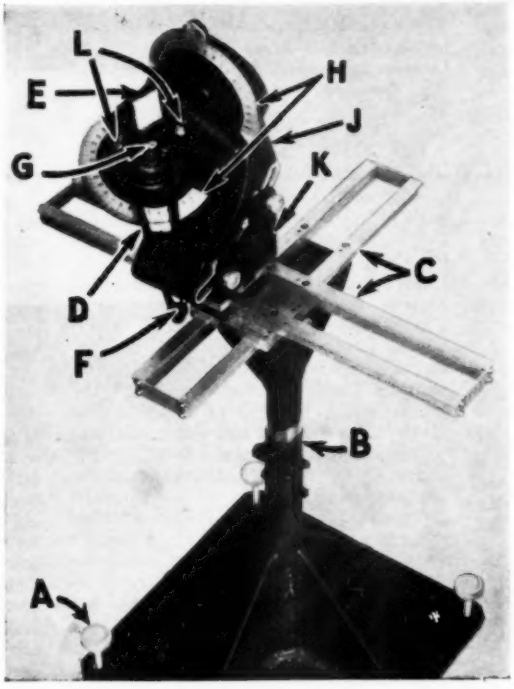
"SAFETY FIRST!" is a slogan that applies to every phase of human activity and this business of flying is certainly no exception.

Like any other comparatively new industry of major proportions, the early history of airplane transportation has been fraught with disasters that took heavy toll in life and property. However, each year has seen improvements in knowledge and equipment which have made flying less hazardous.

As flying increased in scope it became patently evident that a good field of view from the pilot's cockpit was one of the chief requirements for air safety. Since a plane has the attributes of relatively high speed—principal axes unconnected to those of other objects fixed or moving, and maneuverability in three-dimensional space—it will readily be understood that an unusually open field of view is necessary for the pilot.

It was during the World War that the first notable realization of the extreme importance of a good field of view became apparent. Since that time the rapid growth of commercial aviation has added to the demand for a better understanding of vision requirements.

Many methods of determining such requirements have been experimented with, but as no systematic study of the problem had been made, the means of providing an adequate field of view was usually left to the designer. The result of his efforts was laconically labelled by pilots as "good" or "bad."



The N. A. C. A. Visiometer. (A) Leveling screws; (B) Adjustable Standard; (C) Tracks; (D-H) Protractors; (E) Mirror; (F) Sight; (G) Trunnion; (J) Head; (K) Vertical Adjustment; (L) Levels.

However, the National Advisory Committee for Aeronautics sponsored some experiments at Langley Field, Virginia, to determine a practicable method for measuring and presenting the pilot's field of view. The result was the construction of an instrument, named a "visiometer," which permits a step-by-step measurement of the outline of the plane as it is seen by the pilot. These data are then plotted directly on a form of polar chart from which areas may be measured.

By this method an airplane pilot is considered the center of an imaginary sphere having a radius much larger than the distance from the pilot to any part of the machine. The outline of the parts of the plane seen by the pilot may then be projected on the surface of a sphere, the outlines being defined by the lengths of arcs on the spherical surface or by angles which they subtend at the center.

In determining the point to be considered as the center of the sphere these assumptions are made: (1) The height of the plane of the eyes of the average pilot is about 31 inches above the cushion or parachute; (2) In a natural position a movement of the head six inches to either side of direct forward vision is easily obtainable; (3) For planes with adjustable seats, the seat is raised to its highest position for taking-off, landing and taxying, and lowered during flight to give protection behind the windshield.

These factors determine the four positions regarded as representative of those naturally assumed by a pilot under normal conditions: namely, flight attitude, pilot central; flight attitude, pilot to one side; landing attitude, pilot central; and landing attitude, pilot to one side.

The "visiometer" itself was constructed with a steel base designed to fit in the average cockpit-seat. Adjusting screws were provided for leveling. Vertical adjustment and fore-and-aft and lateral tracks permitted the duralumin head to be placed at the desired center of the projection.

The pointer, sighted by the universally mounted mirror, was equipped with a front bead-sight and a rear-ring and cross-hair sight. The intersection of the cross hairs was the point about which all motions of the instrument head were made. The pointer was mounted on the protractors and the protractor-mounting, the latter of which could be rotated around was defined by the angles read on the protractors. Level bubbles were provided for setting up the instrument, the entire weight of which was only 27 pounds.

Visiometer installed.

The method of taking measurements with the "visiometer" is comparatively simple. The locator is placed with its tip at the point used as the center of the projection. The instrument is then fixed in the middle of the seat, the cross-hairs of the rear-sight are placed at the tip of the locator and the protractor is adjusted so that its axes rotate perpendicularly and parallel to the span and thrust-line of the plane.

This position, with the seat lowered to protect the pilot by the windshield, is known as the "flight" attitude. The "landing" attitude is secured by raising the seat to its highest level and adjusting the protractor mounting so that the axis of the hemisphere is below the thrust-line of the plane by an angle equal to the landing angle. In both the flight and landing attitudes the protractor may be moved to either side to correspond with the four above-mentioned normal flight positions.

To make the measurements, the "visiometer" is sighted on points defining the outline of the plane and the data are plotted directly on a chart. Fair curves are drawn through the points obtained. (It has been found that it is simpler and clearer to follow one part, such as a wing or the windshield around to completion, rather than to measure portions of several different parts.) When the cockpit is in the plane of symmetry only the left hemisphere is measured unless some unsymmetrical obstruction exists.

After the angular measurements are made, the distances from the center of the projection to various points on the plane are measured to be used in applying the binocularity correction, i.e., the correction necessary to make the monocular vision of the instrument correspond with the binocular vision of a pilot's two eyes.

Since this method includes the angular measurement and graphic portrayal of the view obtained from the pilot's cockpit, the next step obviously is to plot and chart the data obtained by the use of the "visiometer." However, the representation of a surface of a sphere upon a plane, while long employed in map-making, has its drawbacks and difficulties.

The result is usually a compromise fulfilling one of the following conditions: (1) The area may be kept directly comparable all over the map at the expense of correct shape; (2) The shapes of small features may be kept correct at the expense of a changing scale all over the map, knowing that the large areas will not be kept in their true shape; (3) A compromise may be effected between (1) and (2) and the errors minimized by taking both shape and size into account; (4) Correct directions of all lines drawn from the center of the map may be preserved.

In presenting this angular measurement graphically, methods (1) and (4) are deemed most desirable because of the possibility of measuring and comparing areas in an effort to establish a criterion.

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Questions & Answers

We have had such demand for this department (as well as a constant flood of questions) that we have decided to renew it. So fire away!

K. G. N., Boston, Mass. What is meant by the expression "dead reckoning" when applied to navigation? How is this related to celestial navigation?

ANSWER. Dead reckoning is the method of determining the position of an aircraft (geographical position) by computations made on the distance and direction of flight after leaving the starting point. The distance is usually determined by calculations based upon the speed and elapsed time of flight.

Celestial navigation is the method of determining geographical position from the stars, sun or other celestial bodies. These readings are usually made with an instrument known as a "sextant" that measures the angles made by the planets with the horizon or other fixed reference line.

* * *

J. B. D., Northampton, Mass. Realizing that the barometer reads in terms of atmospheric pressure variations, I wish to know the cause of these atmospheric pressure variations. Is this due to the wind or temperature?

ANSWER. There are two principal reasons for barometric pressure variations. First is the temperature effect which affects the weight of the air through expansion and contraction of its volume. The higher the temperature, the greater will be the volume occupied by a given weight of air and hence the less will be its density or weight.

Second, the weight and pressure of the air mass is affected by variations in the humidity. Water vapor is lighter than air, hence the greater the percentage of water vapor, the lower will be the density and the less the barometric pressure. In actual service, the barometer may be affected by either or both of the conditions.

* * *

D. W. C., Fresno, Calif. Who was Professor Montgomery? I have heard that he made many valuable contributions to aeronautical science, and I wish to find out just what inventions he made.

ANSWER. Professor Montgomery made many glider experiments in the early days with gliders of very original design. They were, in the most part, of the tandem monoplane type with peculiar cambered surfaces of parabolic section, but this principle did not work out well with powered ships. He also was the author of an original theory of flight and wing action which, however, does not survive to the present day.

* * *

W. W. T., Detroit, Mich. How can the lifting power of balloon gas be figured—if there is a method. Also, please tell me whether helium has greater lifting power than hydrogen gas?

ANSWER. Neglecting the weight of the balloon itself, the lifting power of any gas is equal to the difference between the density (unit weight) of the gas and the density of the surrounding air. For example, if the weight of the air (density) is 0.08072 at 32° F., and the weight of the hydrogen is 0.00561 pounds per cubic foot, then:

LIFT = 0.08072 — 0.00561 = 0.07511 pounds per cubic foot.

This is multiplied by the number of cubic feet of gas (displacement) and then the weight of the balloon is deducted to obtain the net cargo or passenger carrying capacity. All this is at a certain definite temperature and atmospheric pressure.

Helium is nearly twice as heavy as hydrogen with about half its lifting power. The density of hydrogen is 0.00561, while that of helium is 0.01114 pounds per cubic foot.

* * *

L. L. L. How does a propeller exert its pulling or pushing power when driving an airplane or airship? Does it screw itself into the air?

ANSWER. There are a number of theories, such as the momentum theory and the blade element theory, but when we get down to basic principles it is hard to discount the first theory entirely, although it is the oldest.

According to the momentum theory, the propulsion provided by the propeller is proportional to the mass of air projected by the propeller and its velocity. In other words, the propulsive force is the reaction obtained by violently bringing a mass of air into motion from rest. In another way, the force is due to an acceleration of a mass of air having a diameter roughly equal to the diameter of the disc swept out by the propeller blades. The greater the mass of air acted upon, or the greater the velocity, the greater will be the tractive effort.

In the blade element theory of Drzewiecki, the propeller blades are assumed to act like airplane wings with the exception that the blades exert "lift" in a horizontal direction. However, whether the blades are considered either as wings or paddles, they both create momentum by the acceleration of the air.

* * *

G. H. F., Cleveland, Ohio. Do you believe that much higher airplane speeds are possible in the future? The present record of 440 m.p.h. seems likely to stand for a long time, according to my ideas.

ANSWER. If much higher speeds are attained than at present, according to data at hand, then we will be compelled to fly in the stratosphere if we continue using the present type of motive power. Even the reduction of resistance in the stratosphere is not all pure gain and therefore we must look for some other

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THE NEW Canadian AIR LINE

by JAMES MONTAGNES

At long last air-minded Canada is about to open her much-sought airline between Montreal and Vancouver.

WHEN the first trans-Canada airway begins operation next spring, it will be largely due to the aviation development in the United States. The planes which will bring Montreal within 16 hours of Vancouver will be the fastest Lockheed planes. The radio beam system and two-way radio communication network from ground to plane will be similar to that established by the Aeronautic Division of the United States Department of Commerce. The pilots who will fly the route will have been trained in the United States on beam flying, and the executive in charge of operations has been recruited from American aviation ranks.

In inter-city airway development Canada has lagged far behind the rest of the world, though the Dominion leads the world in the carrying of freight and express by air, carrying into the northland some three times as much in a year as all United States domestic and foreign routes. Mining supplies and the equipment of new mining towns in the northland above the railway are being carried annually in greater quantities by air in Canada. But inter-city airways will not begin to function till next spring when the first section of the trans-Canada airways will go into operation between Winnipeg and Vancouver. By the summer the Montreal-Vancouver route is expected to be in operation, and Halifax will be 20 hours or less from Vancouver.

To operate the trans-Canada airway the Canadian government has formed a trans-Canada Air Lines corporation in which the government holds 51 per cent of the stock through the government-owned Canadian National Railways which

(*Concluded on page 97*)

Powerful airway beacons have been installed on the line, the same as on American routes.

Most Canadian aviation has been "in the bush" with no regular schedules.

This mooring mast at Trans-Canada's Montreal base was recently torn down.

THE PETOSCOPE —Electric Watchdog

Is this instrument the answer to the stealthy, high-fling enemy airplane? Recent tests have shown remarkably keen perception on the part of this powerful electric-eye.

by S. R. WINTERS

This close-up of the Petoscope shows its extreme compactness and mobility.

UNCANNILY similar to a live watch dog that barks when a moving body approaches, is a recently perfected scientific instrument called the petoscope.

This machine is an innovation of the photo-electric cell which has been directed for the past half century to the accomplishment of varied tasks, ranging from the sorting of beans to the halting of lighthouse signals.

The petoscope, invented in a laboratory at Swarthmore College by Alan Fitzgerald, research associate in electrical engineering is, in its ability to register moving objects, probably the nearest approach to the biological eye yet conceived. The name petoscope is an adaptation of two Greek words denoting power to observe a flying object, and that is exactly what the machine does.

In outward appearance, it resembles an anti-aircraft machine gun. It is able to distinguish free-moving objects traveling in random directions from those which move in a predictable manner at predetermined points. Furthermore, it tells you whenever that moving object comes into view, this by means of a signal bell or horn attached to the side of the battery box. In the center of the control box is an outlet into which an electric horn may also be plugged for the purpose of notifying any interested party who may be out of reach of the bell's sound.

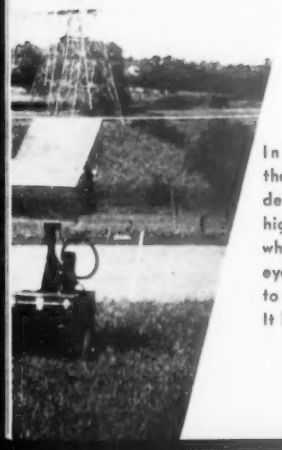
Most of us are familiar with the action of the photo-electric cells as used by individuals the country over for the performance of sundry duties, and especially as employed in the Pennsylvania Railroad Station in New York to automatically open doors at the approach of parcel-laden persons. These cells are light-sensitive. In other words, they emit a weak current when light shines upon them. The current varies with the interruption of the light and the diminutive electrical effect, through an amplifier and a relay, operates a signal or opens a door or performs any one of the numerous uses for which it is designed.

The main reason why photo-electric applications have not come into wide-spread use until recent years is because an amplifier is necessary in conjunction with them. This, obviously, was impossible until the development of the radio and vacuum-tube amplifier, the cells in themselves being unable to furnish but a small-millionth part of an ampere. To elucidate the meaning of a relay for the layman, we quote "a relay is any kind of a gadget by means of which you can make a small amount of power control a much larger amount."

As we already know, to operate the average electric-cell applications, a beam of light must be focused upon them. Interrupting the beam by walking through it causes the door to open—if it be used in a door-opening capacity, but no beam of light is required to operate the petoscope, since the device, like a camera, is wholly self-contained and covers a wide scope of view directable toward any scene in the manner of a camera and not con-

(Continued on page 78)

Below is the original Petoscope as it was used in actual tests. The Monocoupe was flown past at various altitudes, and the instrument detected it each time.



In actual tests the Petoscope has detected aircraft high in the sky when the human eye and ear failed to locate them. It has many uses.

Vertical Airplane Tail Areas

by RAOUL J. HOFFMAN

You airplane builders who have difficulty with tail design should profit from this concise explanation. The home builder will particularly be interested in this treatise.

THE purpose of vertical tail surfaces is to make the airplane directionally stable in the air and on the ground and also to insure stability (spiral stability) in circling flight.

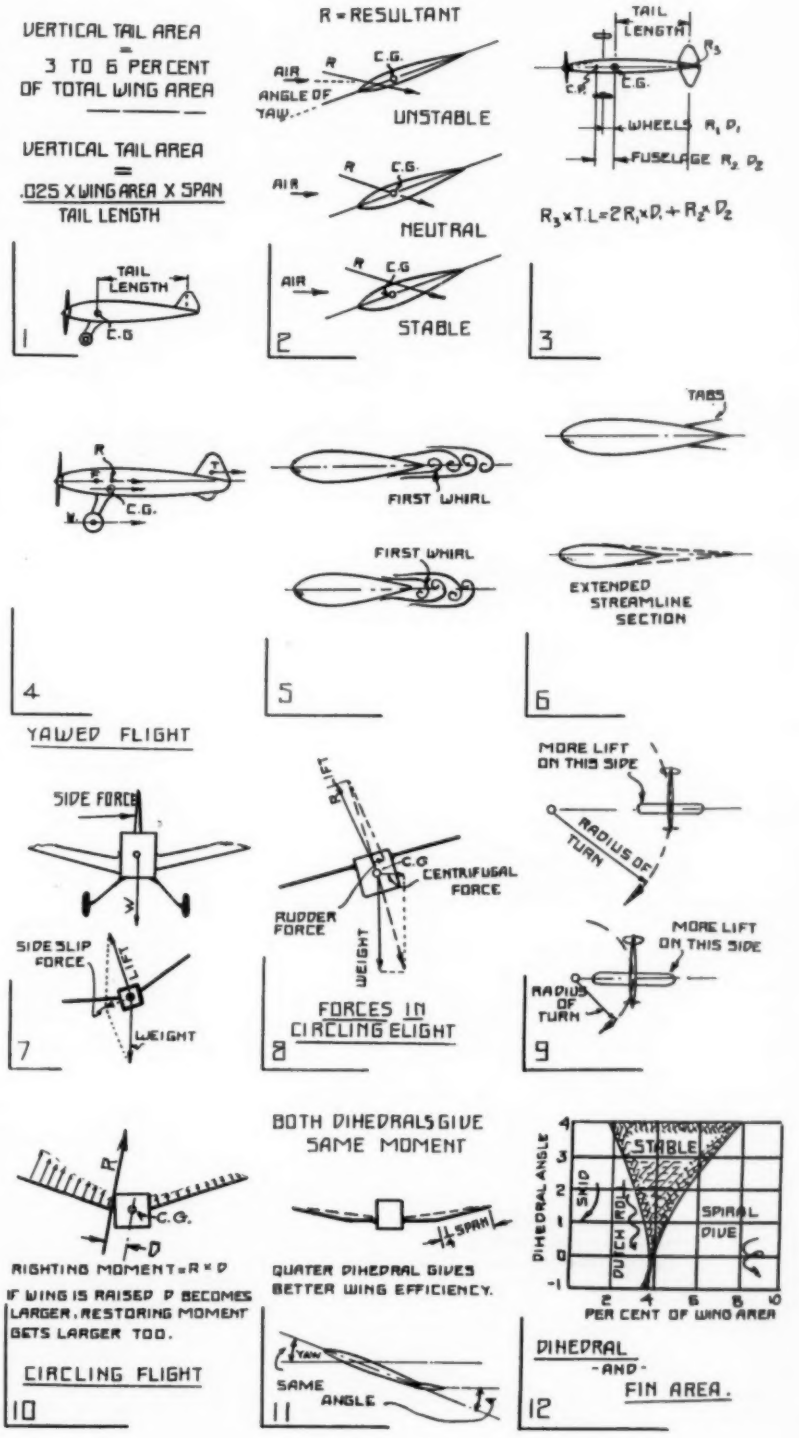
The factors to be considered in designing the fin area—fin and rudder—are the wing area, gross weight, span, location of the tail (tail length), the location of the center of gravity, size and location of the fuselage, hull, nacelle, floats, wheels, tail skids, distribution of weights (moment of inertia), gyroscopic force of the propeller, aspect ratio, efficiency of the tail and its thickness ratio.

These numerous factors seem to complicate an analytical solution; therefore, for estimating purposes, and preliminary layouts empirical formulas are used. One gives the vertical tail area to be three to six per cent of the total wing area; another formula takes the span and the tail length into consideration and it gives the area to be equal to .025 × wing area × span/tail length (all units in feet and square feet) (Sec. 1).

In all investigations for airplane stability, the angular movement will always be considered to be about its center of gravity (c.g.). If the horizontal component of the resultant tends to increase the angle of yaw, the airplane is directionally unstable; if the resultant is aft of the c.g. the airplane is stable, and if the resultant goes through the c.g. the airplane has neutral stability (Sec. 2).

Each exposed part has a certain drag; its resultant is—in yawed condition—intersecting the line of symmetry at a point called center of pressure (c.p.), which is located at close to 25 per cent from the leading edge.

This drag will give a certain amount about the center of gravity. The sum of all drag moments, then, should be equal and of opposite direction of the moment of the vertical tail. Therefore, the sum of all moments must be zero; the resultant will pass through the c.g. Finding the moments by multiplying the center of gravity, adding all moments and dividing the sum by the tail length will result in the necessary drag at the rudder post to balance the forces about the c.g. of the plane. From the required drag it is a simple matter to find the tail area. The estimation should be made first for a small yaw angle (about 3°) in a plan view (Sec. 3); then, using the found area, follow with an estimation in a side view, which usually will place the c.p. of the resultant not at the c.g. (Sec. 4.) By varying



the outline of the tail area, both calculations may result in a neutral stability.

The only trouble with the above method is that there are few reliable data available giving drag and moments of parts at varying angle of yaw. Much time is saved by testing the whole model in a wind tunnel.

This method, which has been used since 1915, may be simplified by assuming that all parts are flat plates and that their c.p. are at their centroids. Naturally, the result will not be correct. An improvement would be to assume that all units are streamline bodies—they usually are in modern designs—and that their centers of pressure are at the quater-point, and their drags are proportional to their thickness ratio.

The "side-area" so often mentioned in directional stability formulae only complicates evaluation for all resistance coefficient are usually referred to the cross-section of the unit and not to the projected area; airfoils are excepted.

It is surprising that the effect of the propeller is neglected in determining the vertical tail area; the rotating propeller creates a gyroscopic force and the stopped propeller puts a large resistance ahead of the c.g. It may be negligible on full-sized airplanes, but not on models.

The area required to place the resultant of all side forces the c.g. (see Sec. 2) would result only in a neutral stability. Additional area is required to have restoring forces present that will tend to revolve the plane to its straight line flight position.

The total area is usually twice the area found for neutral stability, and it should be of the size to insure directional stability during flight or to have dynamic directional stability. Neutral stability may be called static stability.

The dynamic stability is usually a function of the distribution of the weights, which is expressed in the moment of inertia of the plane about its vertical axis passing through the c.g.

If the vertical tail surfaces are streamline sections, a condition arises that may give the airplane a steady horizontal oscillation. This oscillation is caused by the characteristics of streamline sections having minimum drag at plus and minus one degree. Sec. 5 shows how the trailing edge vortices may start their first whorl from one or the other side; the start of the first whorl will decide which way it will yaw; it may be called "side-wash." Its effect is noticeable on large airplanes.

A remedy will be by adding tabs (Sec. 6) or by designing the tail surfaces as an extended streamline section, or using two rudders set at an angle.

It is nearly impossible to investigate directional stability without finding the lateral stability in close relationship.

An airplane flying in a yawed position will—if correctly designed—roll (rotate about its longitudinal axis). If this displacement is small and the resultant force is above the c.g., the airplane will

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New Safety Belt Lessens Head Injuries

Combining a shoulder harness with the conventional safety belt, Air Corps engineers have eliminated a great many injuries in Army flying.

WITH a view to preventing head injuries in forced landings and crashes, a new shoulder safety belt has been developed by the Material division of the U. S. Army Air Corps at Wright Field, Dayton, Ohio. This belt, although it may be worn slack during flight, affording all necessary freedom of body movement, can be pulled taut instantaneously in impending accident, holding the pilot's body rigid in the seat.

The new gear, according to Air Corps officers, is the result of experiments in progress for more than a year in an effort to prevent a common type of accident, involving head injury to operative personnel in military aircraft.

An analysis of reports of all aircraft accidents by the Office of the Chief of the Air Corps disclosed that many serious cranial injuries resulted to pilots and observers from relatively minor crashes. In each case all these accidents had one noticeable feature in common, that is, fracture of the skull evidently caused by the head of the injured person being thrown forward and striking the instrument board, controls, or some other solid object. The analysis of all accidents for 1935, for example, indicated that 94.1 percent of all cockpit injuries involved the head and neck.

Rifle Shell Used for Aircraft Fire Alarm

A FIRE alarm system making use of a .22 caliber rifle shell is now being used on airplanes to flash a warning of the first outbreak of fire. The explosion of the shell lights a red signal on the instrument panel of the plane and sounds an electric alarm.

The shells, special .22 caliber long rifle shells, are mounted at strategic points about the engine to protect it against possible fire. They are attached to tubes leading to the instrument panel. Flame or heat of 250 degrees will fire the shell and flash the signal.

The lead bullet and the powder charge of a .22 cartridge are not used in the rifle shell, the primer being sufficient to do the work. The force of the explosion of the primer travels along the tube and flicks the red signal light. The pilot then releases a container of carbon dioxide gas through a distribution piping system which envelopes the engine in the gas and snuffs out the fire.

The rifle shell was adopted because it would respond to heat or flame quickly, the usual low-melting point metals being too slow to give the alarm in an airplane fire which must be caught immediately. The fire signal is valuable on outboard motors on the wings of a plane where a fire in the motor cannot be seen by the pilot.

Many mid-air fires have proved disastrous simply because the pilot was unaware his ship was afire until it was too late. This is particularly true with modern enclosed outboard engines.

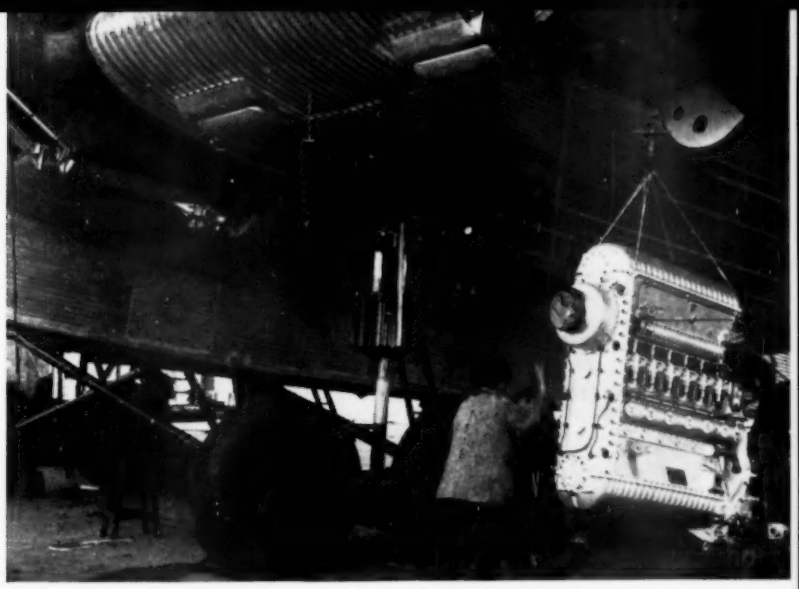
The rifle shell device has also been constructed as an automatic fire extinguisher. Instead of flashing a warning the explosion will release the carbon dioxide extinguisher and instantly smother the flames.

Many of the transport planes in the United States are equipped with this device. The Argentine Government, which recently purchased 100 planes for its army and navy, has equipped 60 of them with the detector system.

DIESEL ENGINES

by

GLENN D. ANGLE



Installing a Diesel engine (above), and a Diesel-powered ship (left).

The Diesel engine long has been the subject of great controversy. Though Americans seem united against the Diesel, foreign makes are successful.

ANYONE who has kept abreast of developments in the aircraft field during the past few years should be fairly familiar with the salient features of the two-cycle Diesel engines developed and produced by Junkers Motorenbau, G.m.b.H. of Dessau, Germany. There are, no doubt, quite a number of comparatively new aviation enthusiasts whose attention has yet to be directed to these interesting designs. While it is for these new readers in particular that we now present these brief descriptions, we are not unmindful of the widespread interest which prevails with regard to the possible use of the two-stroke cycle and of the Diesel principle of operation for aircraft engines, which makes any worthwhile combination of the two a subject deserving of review.

Before we deal with the structural features of the Junkers engine, it might be well for us to consider briefly the history of its development. This will remind us that the fundamental principles embodied in this design are not of recent origin. Moreover, it may lead to a better appreciation of the fact that the development of a new type of engine, even though it be structurally simple by comparison and basically sound from an engineering point of view, may require years of effort, accompanied by proportionate expenditures of money, before it reaches a highly perfected state and becomes adopted in regular service.

The late Professor Junkers began working on an adaptation of his opposed-piston two-stroke Diesel engine for aircraft some time during the World War. This was undoubtedly the first attempt to adapt the Diesel engine to air craft. Active work on this project had to be abandoned early in 1919 in compliance with the terms of the Treaty of Versailles. However, the work was resumed once more in 1925, and it has been followed rather intensively ever since. It was in 1929 that new designs, later to become known as the "Jumo" engines, were announced, and in 1930, the engine passed both German and International types tests. The year following it was reported that the engines had been installed in airplanes to be placed in regular transport service on a line connecting Berlin and London. Just how much service these engines really have had cannot be told here because there are no figures available at the moment. It is safe to say, however, that more actual flying hours have been put in with Junkers engines than any other design of the Diesel type.

The aircraft models all conform to the same general arrangement and they differ from the marine, automotive and stationary Diesel types produced by Junkers in two important respect. The first is that the aircraft type employs two crankshafts (one at each end), and these are connected with one another and to a driving member through a train of gears; whereas, the other types employ a single crankshaft with three throws for each cylinder, the two outer cranks in each instance being joined by tension connecting rods to the cross head of an outer piston. The second distinguishing difference results from the use of a single-stage turbo-compressor geared to the rear of one of the crankshafts in the aircraft design, while scavenging pistons are incorporated in the cross head of the other types to serve a similar purpose.

It is perhaps needless to explain that the Junkers engines under consideration employ two pistons in each cylinder. These pistons are arranged to move in opposite directions. When they approach the end of the stroke which brings them farthest apart, one of them uncovers exhaust ports and the other inlet ports. The exhaust ports are uncovered first in order to relieve the high pressure within the cylinder prior to inlet opening. When the latter ports are uncovered by their piston, a charge of compressed air enters the cylinder and forces the remaining burnt gas ahead of it to complete the scavenging process.

As soon as the ports are covered by the pistons as they return toward center, the fresh air between them is compressed to the point that its temperature is raised sufficiently to ignite fuel upon its injection. Fuel enters the cylinder under a pressure from 6,000 to 10,500 lb. per sq. in., there being four nozzles, each producing a highly atomized flat fan-shaped spray. Two nozzles and the plunger fuel pump which serves them are arranged on each side of every cylinder. The pumps are operated from a camshaft

having a bearing about midway on the cylinders and driven from one end by one of the gears of the train which joins the crankshafts. Usually a single control rod from the pilot's seat may be used to regulate all pumps on one side of the cylinders.

It is not difficult to recognize the simplicity of the arrangement just described, especially the complete absence of the ordinary poppet valve and its oftentimes troublesome mechanism. The port areas in this case need not be restricted and good scavenging should be obtained, particularly since this is one of the uni-flow variety, meaning an arrangement in which the incoming fresh air and the burnt gas move substantially in one direction and therefore do not have so great an opportunity to eddy and mix with each other. The latter feature has become recognized universally as quite essential in the two-stroke engine if it is to have good volumetric efficiency and deliver a power output worthy of its displacement. This is because of the relatively short period which is allowed in the two-stroke engine for scavenging the inert gas and filling the cylinder with a fresh charge, plus the fact that these two processes must occur simultaneously.

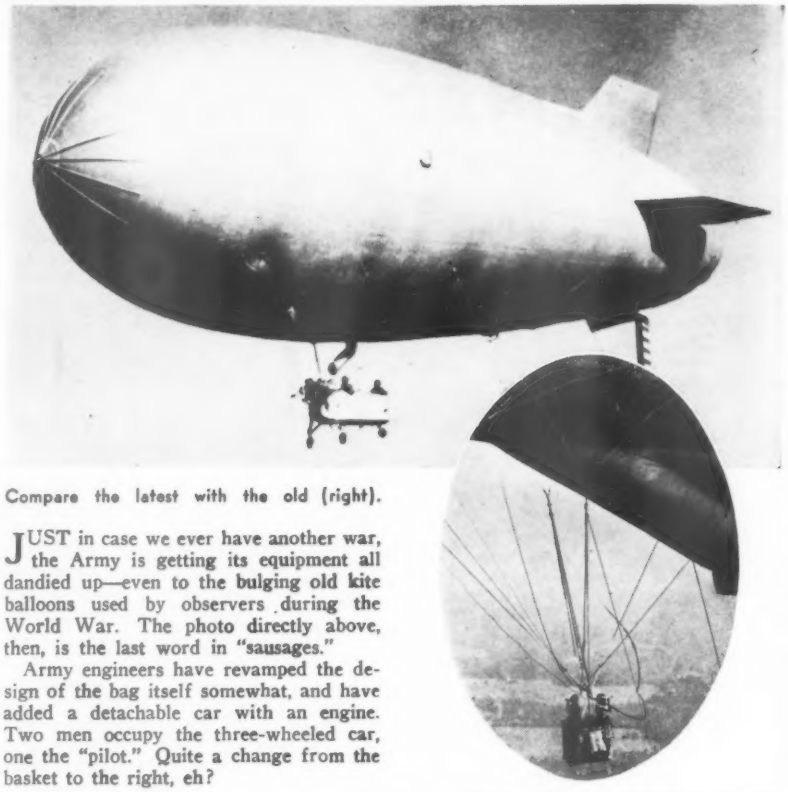
Another feature worthy of our attention is theoretically perfect inertia balance. So long as the two pistons of each cylinder move in opposite directions, the forces resulting from their accelerations are likewise acting in opposite directions and therefore balance one another. This means that the engine is not restricted to some particular number of cylinders in order to avoid vibration originating from such sources as is the case with more conventional designs.

The use of two crankshafts which must be properly timed with each other, as well as connected to a common driving member, may be pointed to as a structural disadvantage. While this is in a sense true, let us consider it the price that must be paid to attain the vitally essential features for good output in the two-stroke engine, as explained in a preceding paragraph, plus the advantages of simplicity in the arrangement and construction of cylinders and valves. At any rate, the use of two crankshafts geared together is a mechanical problem no more difficult of solution than the design of the parts which such an arrangement eliminates. We must recognize that this construction affords a simple and workable application of the uni-flow principle of scavenging, which is really an aerodynamic problem, that is, one which must be dealt with according to the laws governing the flow of gases. Naturally this does not permit much freedom in design, and certainly it is not one that can be controlled easily by mechanical means as many of our earlier two-cycle engine builders demonstrated.

It should be mentioned that the inlet ports are arranged tangentially so that the entering air travels the length of

(*Concluded on page* 90)

Modern Kite Balloons for the Army



Compare the latest with the old (right).

JUST in case we ever have another war, the Army is getting its equipment all dandied up—even to the bulging old kite balloons used by observers during the World War. The photo directly above, then, is the last word in "sausages."

Army engineers have revamped the design of the bag itself somewhat, and have added a detachable car with an engine. Two men occupy the three-wheeled car, one the "pilot." Quite a change from the basket to the right, eh?

Talk About Dreams!

FLYING demands of the pilot a very high degree of concentration in which the attention is directed not only on the manipulation of the controls but also on certain "danger points." These "danger points" are always the same. Even the most skilled of pilots knows that his skill has its weaker points, and that the nervous tension induced by concentration may possibly cause these flaws to become of very great moment. About the times when such conditions of tension exist, pilots are liable to experience certain quite distinct types of dream.

British and Dutch psychiatrists have been investigating this interesting problem. From the results of a comprehensive questioning of a large number of pilots, it appears that their dreams most frequently come under the following types, in which slight variations occur but the background remains the same.

The airman dreams, for example, that he is on the way to a very important airport. He has already flown a great distance, and must reach his destination in half an hour. A crowd is waiting to acclaim him on arrival. Then he finds himself obliged to make a forced landing. He comes down in a large field—and cannot get the machine off the ground again. Beads of perspiration stand out on his face. He must at all costs arrive to the minute. Anxiety, annoyance, fury—over the lost time and the fading hopes of success—all of these rise to torment the dreamer, who is fighting madly but in vain to start his lifeless machine.

Or the airman is flying over a town. Suddenly for no apparent reason he loses height, sinks lower and lower until he is flying along a great and busy street. People scream and run, or stand petrified. Then comes a corner. He must follow the overhead trolley-wires. A sharp bank left, a sharp bank right until there comes a crash, or he is awakened by sheer terror, bathed in perspiration.

The other type of dream is concerned with landing. He is flying in a fog, when houses appear ahead. He must reach the end of the houses, where there is an airport on top of a hill. But as the pilot flies over the houses, the rows become longer and longer. Buildings seem to be springing up on the rising ground of the hill. Anxiously he struggles on towards the hill, while his fuel supply gets lower and lower. Sometimes he reaches his goal. Frequently the houses are replaced by trees or high-tension cables.

Nearly always, however, a pilot has the same type of dream as a result of his particular type of nerve strain.

Make It Invisible!

by JOHN B. LEAKE

Attention, you international spies! Betcha this ultra-exclusive article will give you something to start snooping around about.

"IT WAS plenty tough", said the Captain, as he watched the tired parachute troops leave the plane and march off to the hangars. "All day we fought from shell holes, hoping our army would come up to relieve us before it was too late."

Two days ago, my Sky Raiders bailed out at 5,000 feet and set up the guns in the meadow. We had dropped down, the 600 of us, two hundred miles in advance of our army to block the mechanized divisions of the enemy until our infantry could get into position.

The first day was not so bad, but by nightfall the enemy had appeared in considerable force and where making a determined effort to drive through our positions. Luckily, by midnight, our balloon corp trucks had caught up with us and sent up an observation balloon. That made things easier the next morning, as we were able to silence sections of enemy artillery. Trouble was, those old style kite balloons were easily visible and about ten o'clock a squadron of fighters spotted our observer and shot the balloon down in flames.

"Did the observer escape?" asked the Colonel, who had just joined the group.

"How could he?" asked the Captain, "Did you ever watch a white silk parachute drift slowly down to earth? It makes a fine target. Some day we'll make our parachutes of colored silk or transparent material that will not show against the sky."

"What happened after that?" asked the Colonel, "when you had no observation and the enemy force was increasing continually?"

"Plenty," said the Captain, lighting another cigarette. "The enemy kept pushing up and we had no way of locating their guns. Something had to be done pretty quickly, so we tried the new balloons.

"Every man in the Sky Raiders carries a small deflated balloon in his pack and also a tube the size of a flashlight case full of compressed helium.

"I ordered the men to crawl back, a few at a time, to a grove of trees in the rear, and inflate their balloons. As each balloon was filled, it was attached to one of the cords fastened to the observer's basket.

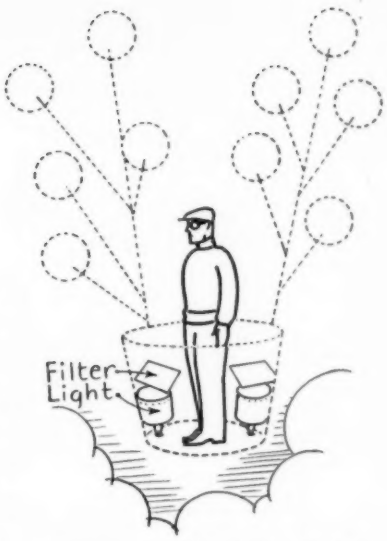
"When half the men had attached their balloons, it took several men to hold the basket down, and the observer prepared to go aloft. The mechanics connected the light wires to the batteries in the basket, the observer stepped in, and I gave the order to let go.

"It was none too soon for the enemy had found the range soon after the top balloon floated above the trees and, as the observer rose swiftly upward, he seemed in great danger of being hit by shell fragments. We were greatly relieved when he finally made himself invisible."

"What do you mean invisible," barked the Colonel, "if he was sitting in plain sight why couldn't they see him?"

"Because you can't see a black cat in the dark." grinned the Captain, "You can't see the outline of a thing if it is the same color as its background. These balloons are painted with a special silvery paint and the basket and the observers' clothes are painted with the same stuff. Below the basket and about five feet to the side are shielded electric lights which send their rays through adjustable color filters.

"The reason the enemy shelled the observer at first was because, in the excitement, we had left the red filter in place, and the whole outfit stood out like a rocket. But we kept waving signals from the ground, while the observer adjusted the color filters, and pretty soon the whole thing, balloons, basket and observer faded out of sight."



Ultra-secret is this sketch of how to make your balloons invisible (!)

"I heard about that," said the Colonel, "but what about the airplanes trying to shoot him down?"

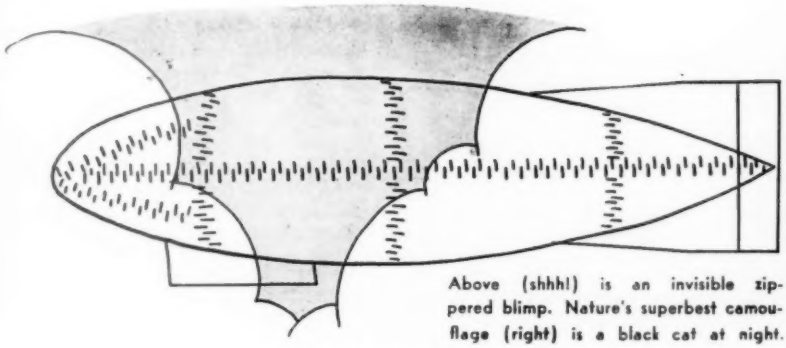
"That," said the Captain, "was so funny the whole company forgot about shells coming over and just sat down and howled. That is, all except our gunners who were now getting the range information and were making the enemy extremely uncomfortable. As soon as the observer disappeared, the planes started circling to find him and never noticed our planes dive at them out of the sun. After that we could laugh all we pleased, for our army came up soon afterward."

"Guess we've seen the last of the old style balloons," said the Colonel, "its too risky hanging a target in the sky for enemy ships to shoot at. Besides they're hard to transport, and the gas supply in big steel cylinders is quite a problem. Do you recall that the first balloons were filled with hot-air and that some long journeys were made in them?"

"There's as much hot air in the world now, as there was then," remarked the Captain—"if not more. Maybe it could be used for something besides politics."

"It already has," said the Colonel. "Down in Australia they have flown balloons with hot air furnished by oil

(*Concluded on page* 89)



Above (shhh!) is an invisible zippered blimp. Nature's superbest camouflage (right) is a black cat at night.

Kites for the Clippers

Here are three Pan American clipper officers testing one of the airline's new kites. Note gloves on men to protect their hands from cable cuts and burns.

KITES are as essential equipment as parachutes on all planes of Pan-American Airways, not for interclipper contests nor the idle-hour amusement of seasoned birdmen, but to maintain communication when an airliner in distress settles on the water.

Preparedness for every emergency which may arise not infrequently spells the difference between life and death to pilots and passengers, particularly where unbroken ocean routes of 600 to 800 miles or more are regularly flown on schedule. When the trailing wire antenna of a clipper or flying boat flops into the ocean and remains there its usefulness temporarily ceases. That means interruption of radio service just when such communication may be most vitally significant. Planes with fixed antenna slung between wing and tail do not solve the problem; they lack the range and wave-length features deemed essential for safe and efficient communication.

The situation verged on a dilemma until an expert suggested the feasibility of hoisting the antenna of a cloudland cruiser forced down on the water into the air. How could that trick best be turned? Balloons were initially tested as emergency line carriers; they proved incapable of supporting the light loads in a stiff breeze.

Hugo Leuteritz, Pan Am's communications chief, then shifted his study to kites. His spare time during the summer was spent in flying kites of all sizes and descriptions at Rockaway Beach on Long Island. Colonial critics generations ago scoffed at Benjamin Franklin's kite-flying antics on the Philadelphia commons. Their ridicule was in minor tempo to the laughs which Leuteritz provoked. A grown man forever monkeying with kites!

Franklin fathered electrical research in these United States; Leuteritz perfected a kite which would tail an antenna wire in practically all kinds of weather; both these gentlemen enjoyed the last laugh, and the loudest.

Nowadays every flying boat and amphibian in the Pan American Airways' fleet carries a kite—standard equipment—packed away in a mailing tube as tall as a man. That liliputian flying unit of a modern flying machine consists of small tubes of duralumin to serve as kite sticks, halter and strings of stainless steel wire, and a cover of airplane fabric painted a flaming red.

In but a few split seconds as an amphibian in distress descends to a watery landing the kite may be assembled and flown from a hand-toss takeoff. A wing nut has to be screwed in place; several safety pins in lieu of cotter pins fastened through holes in the ends of the sticks. Presto! The kite is ready to soar above the dropping plane; it thumbs its nose at the weatherman's predictions of rain and wind which ordinarily would ground all planes.

The novel kite is adjustable for light, medium, or heavy wind by merely changing the loop of the flying string. A simple reel charged with 50 feet of stout line is employed in flying the weatherworthy kite even during a drenching downpour. Not only does the K6—that is what the officials dub the kite—maintain complete radio facilities by holding the antenna aloft, but it also serves as a flag of distress to attract searching planes and boats to the stranded clipper.

This bow-kite wonderworker which functions in a 35-mile gale or tropical "gullywasher" ascends from a standing

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Mama Rides Free!

PROBABLY the toughest customer in the world the average airline has to win over is "the Missus." All American airlines have known, and have attempted to combat this handicap, for many years. Only recently, however, did most of the nation's leading airlines rub noggins together in an attempt to work out a solution to "do something" about the cold-hearted Missus who refuses to let Papa fly under any condition. Besides refusing to fly herself.

So United Airlines (one of the several who are using the stunt currently) worked out this nefarious little plot:

For one experimental month United decided it would transport, as guests of the company, the wives of husbands who purchase one-way or round-trip tickets between Chicago and New York. These novel "courtesy flights" won't cost Mama one penny—so long as Papa buys his ticket.

The decision of the two companies to make this offer to the wives of the nation's two largest cities followed the trying out of the experiment between San Francisco and Los Angeles several weeks ago. The educational results were so satisfactory that the offer was extended to the east.

In the announcement to the public, a United official said: "If you are a wife who puts her foot down on flying, it is probably because you are unfamiliar with flying. To convince wives that air travel is dependable, we are willing to go half way, as we know that if you are acquainted with air travel, as it is conducted today, not only will you approve of your husband flying but you will fly yourself on subsequent trips between Chicago and New York."

The airlines announced also that the wife may bring without charge children under two years of age, and with advance notice, baby food will be put on the plane and served by the stewardess or hostess.

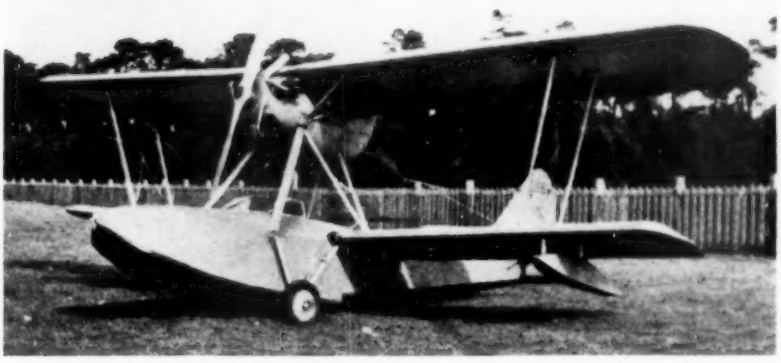
"The decision to invite wives to accompany their husbands, as guests of the line, is a new sales approach to interest wives in flying and to give force to the old 'saw' that 'two can live as cheap as one'."

But there are flaws in even the best of ideas. The catch in letting mama ride free of charge is that the offer has literally swamped some lines to the extent that, as you read this, the companies involved will probably have discontinued this courtesy. The basic idea, though, was even sounder than airline traffic departments anticipated. The stunt not only sold a great many hitherto hesitant women on air travel; it sold them so well they traveled all over the country with their husbands, meanwhile continually urging papa to fly. One thing was achieved, however, and that was a series of well-filled passenger lists.

END

FISHING with an AIRPLANE

by JASPER B. SINCLAIR



This old Savoia-Marchetti amphibian has proved a valuable aid to fishermen.

It is easier to locate schools of fish from the air than would be expected. Two enterprising Californians have been flying a "fish patrol" for some time.

FROM the Pacific coast comes news of an experiment that may have some far-reaching effects. Not only along the western rim of the American continent, but elsewhere in the world, as well. The experiment concerns the linking of one of mankind's newest industries with one of the oldest. Briefly, it concerns the recent announcement that operators of the fishing craft making San Francisco their headquarters intend using aviation as an aid to the sardine fleet.

Behind that declaration of policy is an interesting story. A story of American enterprise and courage in the development of a new angle to an old trade. Some of the old-timers in the business, skeptical of all change, shake their grizzled heads in genuine disbelief at the mere mention of this trail-blazing experiment. Fishing is a fisherman's business, they will tell you. No sky pilot, winging his swift way above the waves, can ever enrich the cargoes of the sardine boats. So the old-timers down at Fisherman's Wharf and along the Embarcadero affirm. But experiments have proved otherwise.

As originally outlined some months ago, plans called for the use of a seaplane to scout along the Pacific coast for phosphorent evidence of fish. The plane must be radio-equipped, it was agreed, thus enabling it to keep in close communication with the radio-equipped boats of the fleet. Most sardine fishing, especially in California waters, is carried on at night. With proper visibility a low-flying plane can detect a phosphorent glow in the water—the inevitable undersea trail of the sardine.

The idea was not far-fetched, of course. As far back as world war days airplanes were used to a limited extent in scouting for submarines lurking in the ocean depths.

So much for the general aspects of the plan. Credit for putting it into operation in northern California waters goes to the California Sardine Products Institute of San Francisco—and to the "sardine scouts," Charles Garniere and Dudley Williams.

Garniere and Williams, pilot and co-pilot in this particular enterprise, hail from Portland, Oregon. Both are quick to discount the suggestion that they are pioneering this particular phase of the air industry. The pair entered into the work simply for the sake of "doing something different," as much as anything else. The call of adventure that no routine job can satisfy was an impelling motive. The same call of adventure that sends other flyers soldier-of-fortuning into every little scrap that makes the newspaper headlines.

But Garniere and Williams are level-headed, purposeful fellows. They've set their hearts on this sort of pioneering. And if you ask their employers, you'll hear nothing but warmest approval of the manner in which they do their job. Their plane, an old Savoia, has seen considerable service itself. It was built in the United States by the American Aeronautical Corporation some years ago. At one time the plane was the property of the late Smith Reynolds, heir to the Reynolds tobacco millions. Young Reynolds took the Savoia aboard ship on a round-the-world cruise several years ago, doing bits of flying in almost every country included in the vessel's far-scattered ports of call.

Also equipped with landing wheels, the Savoia takes-off equally well "on land or water." With a single 125 h.p. motor it has a speed limit of 80 m.p.h.

Garniere and Williams had just finished operating their Savoia out of Portland along the Oregon coasts in the fall of 1937. There they had already scouted for sardine with a fair measure of success. When the California Sardine Products Institute definitely decided to go through with their plan they signed the pair for a month's scouting off the port of San Francisco with their tiny plane. There was nothing haphazard about their operations in San Francisco waters last December. Nor, in fact, about any phase of the experimental flights. Most of the surface areas surveyed were plotted out in advance of the actual daily flights by the staff of the California Sardine Products Institute. The plane merely followed the course already outlined, its occupants noting on the charts all data of interest to their employers—such as appearance of schools of fish, evidence of abundant undersea plant life and presence of great numbers of sea birds (in itself an indication of the presence of sizable schools of small fish).

The Institute desires to stress the fact that it was not so much interested in direct results obtained from these experimental flights at the moment, as it was in a survey of general oceanic conditions and future possibilities of developing the idea more broadly. In this respect the test flights were regarded as highly successful. They demonstrated beyond any doubt the practicability of linking aviation with off-shore fishing.

The annotated charts and daily reports of their work turned in by the plane's crew are models of accuracy and detail. That is one of the most pleasing aspects of the entire test period, from the Institute's standpoint. As their employer declared:

"The future of their job depended upon these young men reporting the presence of large schools of sardine. It depended upon them stressiing the vital importance and advantages to the industry of the use of a scouting plane for this purpose. They did neither! They reported their failures with the same degree of frankness and completeness that marked their most successful flights. There was no exaggeration in any of their reports. They were equally frank to admit that they had met with more success off the Oregon coast earlier in the year."

The comparison, though, is hardly an equable one, even if the men themselves made no attempt to alibi their work. Circumstances and conditions differed widely in both experiments. Up north the scouting was undertaken several months earlier in the season, when sardine are much more plentiful than later in the year. Weather conditions and visibility

are generally better in the autumn months than in December.

It is also true that there has been a marked shortage of fish in northern California waters this present season. California's total sardine catch from August 1 to December 31, for example, was only 328,000 tons in 1837. For the same period in 1936, it reached a total of 519,000 tons.

In San Francisco the industry reports itself satisfied with the results of the experiments carried on by Garniere and Williams. So much so that, as matters now stand, it intends enlisting aviation's aid next season again in a attempt to better the seasonal catch.

Next season it is planned to start earlier in the year. In northern California waters, in the San Francisco and Monterey districts, the sardine season runs from August 1 to February 15. Oregon, on the other hand, sets no seasonal limits.

A few years ago the work of Garniere and Williams along this line would have had dramatic value. Nowadays it is accepted pretty much as commonplace by the general public. But it is far from that! These men are pioneering a phase of aviation—and of deep sea fishing—that may develop far-reaching effects. Time alone can gauge the importance of their work.

For their operations off San Francisco the plane was based over at the Oakland airport. One day's flight routine is typical of the rest. Taking-off in late afternoon they headed out through the Golden Gate to the open sea. Before setting their seaward course over the route to be surveyed, the crew got in radio communication with the United States Coast Guard at Point Bonita and with the Farallones lighthouse for last-minute weather and wind reports. Then the pilot dipped the plane opposite Point Bonita as a signal to the Coast Guard that the Savoia was heading seaward. Point Bonita in turn at once telephoned the California Sardine Institute, in downtown San Francisco, the exact time of the plane's departure to sea.

When the day's scouting was done the plane again signaled Point Bonita of its return. Again the Institute's headquarters were notified that the plane had set its homeward course. In this respect the United States Coast Guard did its customary splendid job of cooperating with private industry. It is worth noting, too, that the United States Bureau of Fisheries and the California Fish and Game Commission both lent their co-operation to the fullest extent in this experimental survey, though the Institute itself financed the tests.

The relayed telephonic messages between the Coast Guard and Institute headquarters were purely safety-first measures. The exact duration of each day's flying activities was pre-determined. Any failure of the plane to appear off Point Bonita within a reasonable time after it was due would indicate trouble of some sort. In the event of any untoward delay in its departure or return, the Institute could speedily request Uncle

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New Lockheeds for Holland

Above is one of a batch of Lockheed "14's" now being delivered to KLM, the Royal Dutch airline. The Dutch line long has been a user of modern American ships.

EXPORTATION of an order for several new Lockheed "14" airliners recently was started. The ships, for KLM, the Royal Dutch airline, are en route to the Netherlands as this is being written.

It was a "14" (also known as the *Sky Zephyr*) which crashed some time ago in Montana while flying a Northwest Airlines route. Despite rumors, however, not a single order for these ships had been cancelled; shipments of the KLM lot was started shortly after. According to Lockheed officials, orders on their books called for 80 of these airliners, and production has gone ahead. Besides American orders, "14's" are on order to Roumania, Bulgaria, Poland, the Netherlands, Canada, Australia as well as Czechoslovakia.

Though no definite speed figures were known as we went to press, the rated speed of the "14" shown above was 243 m.p.h. maximum at 5,800 ft. Cruising speed at 10,000 ft. was said to be 223 m.p.h.

One of the outstanding features of the "14" is the set of Fowler flaps, installed on an airliner for the first time. Essentially, this flap serves as an auxiliary wing. When not in use, it retracts into the ship's main wing. In use, however, the extended flap drops below and behind the trailing edge of the wing at a greater angle of incidence, thereby increasing the lift of the main wing at low or stalling speeds.

New Gliding Field at Elmira

FOR years the favorable winds around Elmira, New York, have attracted soaring enthusiasts and made Chemung County one of the gliding centers of the United States. Elmira's progress as a soaring center now promises to be greater than ever before, as a result of the Harris Hill Glider Field which was dedicated on the eve of the eighth annual meet of the Soaring Society of America. The Harris Hill Field was made possible by the Works Progress Administration and Chemung County.

Harris Hill, some eight miles out of Elmira, has long been used as a glider field. The site is a table-like field, almost level, the lower edge of which slants gently down to the sloping hillside. The field is about 1,000 feet long and 200 feet wide.

In previous years when soaring meets were held at Elmira, the participants had to depend for accommodations on tents at a nearby farm house. Even the administration office for the meets was only a tent.

Now, WPA workers have completed a well equipped administration building, five cabins furnished with bunks, a comfort cabin, and a modern hangar. These improvements afford ample accommodations for the glider enthusiasts who use the field.

The field itself has been graded by the WPA, and rolled to make a more level surface. A well was sunk to assure an ample supply of pure water.

Another improvement is the reconstruction of the two mile road over which gliders must be hauled to the field. This road has been widened, graded, straightened, gravelled and surfaced, making the field much more easily accessible.

The dedication address was made by Perry Fellows, assistant chief engineer of the WPA in Washington. Richard duPont, president of the Soaring Society of America, and William Enyart, official of the N. A. A., both took part in the ceremony.

The development of Elmira as a center for gliding and soaring may be attributed to Dr. Wolfgang Klemperer. Dr. Klemperer was formerly a resident of Germany and at one time holder of the world's record for duration of flight. This was during the period immediately after the World War when gliding and soaring became popular in Germany because of the severe limitation of power planes imposed by the Versailles Treaty.

By 1929 Dr. Klemperer had become a resident of America and was a research engineer with the Douglas Aircraft Company. He began gliding and soaring activities around Akron, Ohio, and was subsequently asked to find a place in the eastern United States suitable for

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Selection of Wing Sections

by RAYMOND A. BITTNER

By very simple means, the author shows how to choose the proper wing section for a given performance from the wind-tunnel data published by the Advisory Committee on Aeronautics.

OF the many problems that confront the airplane designer, one of the most important is the choice of a suitable airfoil section. Usually the amateur designer receives a few reports from the N. A. C. A. showing the curves of various airfoils, but to pick the right airfoil for the plane intelligently is another thing.

The purpose of this article is to show how to evaluate the characteristics of the airfoils given in the various N. A. C. A. reports as simply as possible and without being too technical.

Quite a few fellows may ask, "What difference does the section make?" Or they may say, "So-and-So used X airfoil and got fair results, why can't we use the same section?"

Well, would you use the same airfoil on a glider and a high speed racing plane? Of course, not. Each airplane requires the ailfoil best suited to the purpose for which it was built.

Let us assume we wish to select an airfoil for a single-place lightplane, with a 40 h.p. motor, an estimated top speed of 90 m.p.h., with a gross weight of 525 pounds and a landing speed not faster than 35 m.p.h.

For comparison, we will use the famous old Clark Y and the N.A.C.A. 2415 airfoil, and then see which one would be the best airfoil for our job. Remember, fellows, almost all airfoil characteristics given in reports are for an aspect ratio of six. So we will assume our job is to have an aspect ratio of six also.

The effect of decreasing your aspect ratio to less than six decreases the lift and increases the drag of the airfoil. Increasing the aspect ratio to more than six increases the lift (within limits) and decreases your wing drag. If you are planning an aspect ratio other than six, there are correction characteristic curves for different aspect ratios, which can be found in any good book on aerodynamics.

The first thing to do is to make a small table, giving the characteristics of the airfoil, so that they can be read at a glance. All characteristics that are needed for our work are shown in the accompanying airfoil curves.

There are many wing sections, now ordinarily passed over by the designer that have real merit under certain definite conditions.

AIRFOIL COMPARISON

		Clark Y	2415
1	Maximum C_l	1.56	1.54
2	Minimum C_d	.0177	.0099
3	Maximum L/D	21.1	20.8
4	Thickness in % of chord at 15% from L.E.....	11.1	13.39
5	65% from L.E.....	8.25	10.34

The following formulae will be used in our computations:

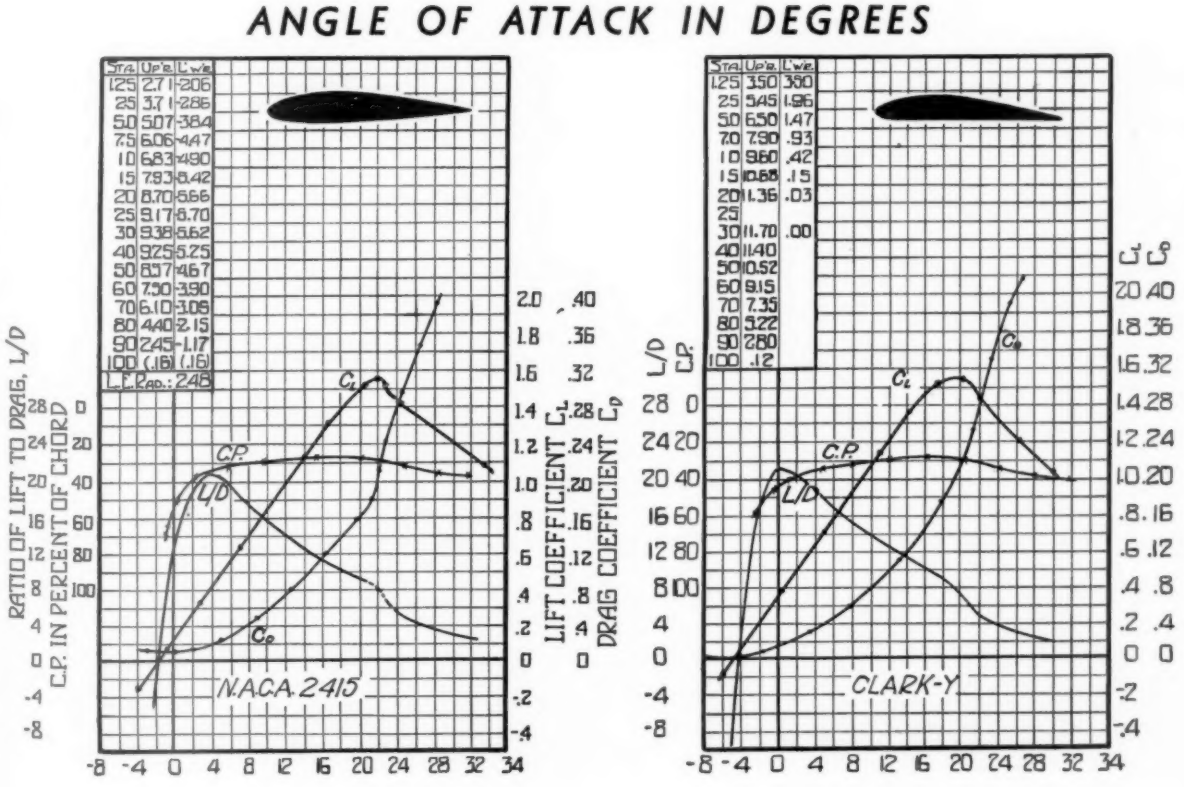
$L = Ky\ A\ V^2$

$D = Kx\ A\ V^2$

$$\text{H.P. required} = \frac{D\ V}{375}$$

Where: L is lift
Ky is lift coefficient
A is wing area in square feet
V^2 is velocity squared in miles per hour
D is drag
Kx is drag coefficient

We will start with the Clark Y section. Our problem is to determine how much



power is required to fly the Clark Y wing at 90 m.p.h. First, we must determine the amount of wing area necessary to land at 35 m.p.h., the next step is to determine the wing drag of the section, and then we can calculate the amount of power required by that section.

The maximum lift coefficient C_1 of the Clark Y is 1.56. To change this to Ky just multiply by .00256:

$$Ky = 1.56 \times .00256 = .003993$$

Wing area required for landing at 35 m.p.h. is found from: $L = Ky\ A\ V^2$, and solving for area: $A = \frac{W}{Ky\ V^2}$

$$A = \frac{525}{.003993 \times 35^2} = 107.5 \text{ square feet}$$

of wing area.

Now we must change Cd to Kx: $Kx = .00176 \times .00256 = .0000450$. $D = Kx\ A\ V^2 = .0000450 \times 107.5 \times 90^2 = 39.22$ lbs.

We can now use the formula h.p. required $= \frac{D\ V}{375}$, to find the horsepower required by the Clark Y section when flying at 90 m.p.h.

$$\text{H.P. required} = \frac{39.22 \times 90}{375} = 9.44 \text{ h.p.}$$

At first glance, 9.44 h.p. seems rather small, but when you realize you have a total of 40 h.p., assuming a propeller efficiency of 75 per cent, you only have a remainder of 30 h.p. to overcome the drag of the whole airplane.

Next, we can determine the amount of power required by the N. A. C. A. 2415 section. We go through the same procedure as for the Clark Y section.

$Ky = 1.54\ C_1 \times .00256 = .00394$, then our area is:

$$A = \frac{525}{.00394 \times 35^2} = 109 \text{ square feet.}$$

$Kx = .0099\ C_d \times .00256 = .00002536$.

Drag of section is $= .00002536 \times 109 \times 90^2 = 22.38$ Lbs.

$$\text{H.P. required} = \frac{22.38 \times 90}{375} = 5.36 \text{ h.p.}$$

To fly at a speed of 90 m.p.h., the Clark Y section requires almost twice the amount of power needed by the N.A.C.A. 2415 and the power saved by using the N.A.C.A. 2415 section can be used to increase the performance of the plane.

Of the two sections, the superiority of the 2415 is quite apparent. We use the table to list the characteristics of the airfoils we are going to compare, so that they can be read at a glance.

(1) The maximum lift coefficient shows which airfoil, for a given weight and wing area, will give the lowest landing speed.

(2) The minimum drag coefficient of the N.A.C.A. 2415 shows that this section would probably be suitable for high speeds.

(3) The maximum L/D of each wing section is given, because it is a general

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The Adventures of Ward T. Van Orman

by Helen Waterhouse

Fully as fascinating as the adventures of an aviator are those of the world famous balloonist Van Orman.

MANY a humorous incident, many a narrow escape, and adventures galore filled the days of the first young students of free ballooning and their instructors during world war days, according to the diary of Ward T. Van Orman, world famous balloon pilot.

"Van's" tales, which are here being published for the first time, are graphically told.

"It is a big thrill to descend in a balloon until the drag rope touches the ground," he writes. "Especially the first time you try it. It produces violent jerks on the basket.

"The drag rope, be it understood, is a rope an inch in diameter, and 150 feet in length which acts like a huge shock-absorber as the balloon descends to the ground, and which slows up the forward speed of the craft by dragging over the surface of the ground.

"One night we were just about to pass over a farm house, a few hundred feet ahead of us. The first thing we knew, our drag rope was touching the eaves of the porch, then it dragged and sawed over boards. Presently it bumped over the tin roof and the tail slapped down on the porch in the rear with a terrific bang.

We quickly started to pour over two bags of sand and thus lifted the rope off the house, but just as we had ascended to about 200 feet, a farmer in a long night-shirt, with bare legs and slippers came to the house door with a lantern in his hand.

"He was investigating the terrific noise which had apparently awakened the entire family, and we saw that he was fingering his shot gun. Commander Maxfield, the man with me, whispered 'Be quiet.' We were afraid that he would discover us and shoot holes in the balloon. But as we watched, we saw the lantern circle the barn and the house several times and finally stop on the back steps again. It was evident that the poor farmer was worrying and puzzling over what had caused the noise, but he never thought of looking up where we hung motionless in the sky over his head.

"We continued noiselessly up to 2,000 feet, flew another hour, and breathed easy again. Our prank had not been discovered.

"Once we landed near Stuart, Virginia, and upon descending were surrounded immediately by an interested group of farmers. One woman prostrated herself upon the ground and shouted at the top of her voice that the Angel Gabriel had again come to the world. It was hard for me to decide just exactly which one of us looked like the Angel Gabriel.

"Again, we started out from the training station and were amazed to find that the rip-panel in our balloon had dropped out at five thousand feet. The rip-panel is, of course, simply a device for slitting the top quarter of the balloon, allowing the gas to escape almost instantaneously, and is used only in landing when the winds are higher than twelve to fifteen miles an hour.

"Of course, when the rip-panel falls out, the gas begins rushing out, and there was nothing for us to do but use our remaining ballast as best we could to check our fall. It looked as if we were going to get pretty badly banged up and I was already bracing myself for the shock of the crash when we struck the ground, but to our great relief we landed in the top of an apple tree, quite gently, and from there dropped easily and quite unhurt to terra firma.

"One of my students, on his solo flight, sent his balloon equipment back to the station with the ropes of the basket entirely cut off. A close examination indicated that the ropes might have been burnt rather than cut. I called the student in, and got an explanation which at first seemed almost incredible. He said that the balloon had struck telephone wires in landing and later we were able to confirm his story and found that the ropes of the basket slid along a 'phone wire between the poles and was severed by the friction of the wire."

Van's ballooning incidents vary from thrilling escapes to amusing and highly enjoyable adventures.

"On one particularly cold winter morning we were approaching Salem, Ohio, with the thermometer on our balloon standing well below zero," he relates. "We were terribly cold ourselves and wishing we had a hot breakfast rather than cold sandwiches to munch. Suddenly, we heard someone calling us from far below and saw a woman standing on her back porch on the outskirts of the town shaking a tablecloth. We listened for a moment and made out that she was inviting us to breakfast. We shouted 'What have you?' and she came back promptly with the response, 'Hot cakes.'

"It was an invitation which could not be passed over lightly. We conferred a moment, decided to chance it, and drifted over a woods and descended in the next field. We tied our craft to a firm fence post and tramped back to the farmhouse.

"A more surprised woman than that farmer's wife never existed. She soon recovered enough to stir us up some pancakes and we thawed out in front of her hot fire while we stowed them away.

"Occasionally, the students brought back stories of their drag ropes swinging in front of trains. The possibility of having the rope caught by the train, thus snapping the balloon forward, seemed to intrigue them although I never heard that one really did that.

"One day we decided to balloon to New York to see General Pershing's

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GEODETIC CONSTRUCTION

by JAMES P. EAMES

Geodetically-built airplanes are an important subject today. They perform exceptionally well.

GEODETIC aircraft structural members derive their classification due to the fact that their neutral axes are so arranged as to coincide with geodetic lines traced upon the exterior of the involved structures. Geodetic lines may, in turn, be defined as those lines following the shortest along the path of a curved surface between two points located on that surface.

This form of construction has been adopted by aircraft designers since it apparently combines the advantageous features of the stressed skin application with the higher degree of strength characteristics involved with construction incorporating structural sections of more concentrated area. It remains an undeniable fact that the employment of airplane construction material in the form of flat sheets to attain the required condition of torsional stiffness represents the least acceptable shape for load resisting application. However, the smooth, glossy surface presented by aircraft stressed skin construction, with the attendant favorable results from the standpoint of skin friction and the avoidance of rough edges and surfaces where the boundary layer is encountered, incorporates excellent aerodynamic characteristics.

If the construction material could possibly employ more concentrated areas, such as is incorporated in bar, tubular and channel section, the structure thus fabricated would tend to develop a much greater resistance to applied loads. This pertinent fact forces designers of stressed skin aircraft employing materials in plate or sheet form to select one of two alternatives—a light wing loading emanating from a necessarily low value of safety factor, or an excessively heavy structure.

Geodetic aircraft structures combine the aerodynamic cleanness of stressed skin construction with the increased strength characteristics incorporated into tubular and channel wing spar and fuselage construction.

A geodetic wing structure is illustrated in platform by Figure One. The diagonal members are composed of stainless steel or of duralumin channel section arranged with their widths normal to the wing contour. Special fittings in the form of gusset plates are welded or riveted at the intersections of the channel members.

Geodetic fuselage construction follows the same general arrangement as that incorporated in the wing structure, and is illustrated by Figure Two. Reference to both drawings readily demonstrates the fact the material is located precisely where it is most required—along the contours of the structures where the greatest strain from the applied loads is encountered.

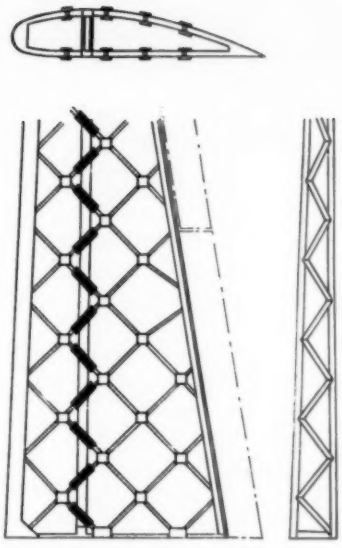


FIGURE 1 shows a geodetic wing top.

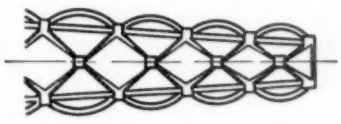


FIGURE 2 is a geodetic fuselage.

Geodetic structural framework may be covered with fabric as well as the conventional stiffer materials including sheet metal and plywood. Any of these combinations are capable of presenting a smooth, highly-polished surface comparable in every respect to stressed skin construction.

From the aspect of vibration and sound transmission, geodetic aircraft construction presents further favorable characteristics since the geodetic web, formed, as outlined above, of channelled diagonals gusseted at their intersections, has proven to be non-resonant.

The hollow interior, resulting from the construction material being concentrated along the structural contours, offers increased accommodation facilities for passengers, cargo and fuel storage tanks. This feature also permits the installation of telescopic variable wing

(*Concluded on page* 91)

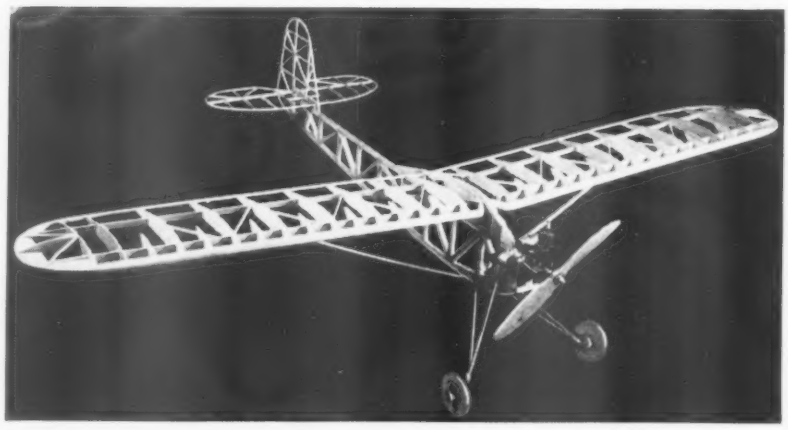
Both the Vickers "Wellesley" above and the Vickers "Wellington" below have been adopted by the British Royal Air Force and have shown themselves to be exceptional weight carriers.

A Simple "Stick" Gas Model

by

PAUL W. LINDBERG

Model Editor and Model Designer for
POPULAR AVIATION



The simplicity and sturdiness of this easily built gas model are evident from the framework shown above. An ideal design for your first adventure with gas type models.

THIS month's gas model was designed to fill the demands of many of our model builders. We have had a great many letters requesting a model that could be built in a very short time and yet have every good flying characteristic. We guarantee you that this model possesses all these things plus a world of enjoyment in building it. The model is easily knocked down so that it may be carried around.

Please remember that this model does not possess the ultra-modern lines of a finished scale model. It was primarily designed to satisfy any beginner on his first gas model as well as the novice who wishes for a simple gas model that he can knock about. Any 1/5 or 1/6 h.p. motor will give this model a very fine performance.

Construction of Fuselage

When constructing the profile fuselage, select two ½-inch pieces of basswood for the main longerons. One-half inch square balsa upright and diagonal braces are cemented in between the two longerons with the exception of two basswood uprights at the front of the fuselage where the landing gear struts are tied in. The curved front under portion of fuselage is made from ½-inch thick solid balsa. This is spliced in with the basswood longeron as shown on plan. Note balsa fillets at this junction.

Making sure that the cement is thoroughly dry in all the joints, the framework may be removed from the surface constructed upon. One-inch No. 18 wire nails are driven through the longerons into the balsa uprights to re-inforce the fuselage.

At the top of fuselage is a curved piece of ½-inch thick balsa cut to shape as shown on plan to receive the wing panels. It is very important that the holes be drilled accurately in this balsa piece so as the proper setting of the wings may be had. Note: The reinforcements on either side of this ½-inch thick balsa extend down to under side of top longeron. These are necessary to prevent any shearing off of this balsa wing center support.

Next we make the 3/16-inch plywood motor mount support which is cemented and nailed to front of fuselage. Small balsa reinforcements are cemented in at bottom section of plywood front in order to secure added strength at this point.

Construction of Landing Gear

From ⅛-inch steel spring tempered wire, form the landing gear struts for either side of the body. There will be two front and two rear struts which are bound to the basswood uprights with strong thread. Apply cement sparingly to these joints. The 1/16-inch curved spreader bar between the landing gear struts help to support as well as give the landing gear the extra amount of shock needed for hard landings. The wheels are next placed in position followed by small streamlined hub caps to trim up this part of the ship.

Construction of the Wings

These are constructed upon a flat surface in very much the same manner as the body. One-eighth-inch x ¾-inch front spars are used and ⅛x½-inch for the rear spars. Pin these in position the proper distance apart. After all your ribs have been cut from 3/32-inch sheet balsa, they are notched to fit over these spars. The leading and trailing edges are next to be cemented in position after they have been properly shaped and sanded. The wing tips are built up from 3/16-inch square diagonal braces. It is necessary that all bracing be cemented in the wings as shown on plan so as to prevent any warping of wing while being covered.

The struts are clearly explained on the plan as well as their fittings. These are of the single member type, so no trouble should be encountered here.

Construction of Elevator and Rudder

Construct these upon a flat surface using 3/16-inch thick sheet balsa for the tips. The elevator is made adjustable with a small piece of tubing bound with thread and cement in the center of bottom side of elevator spar. This in turn rests upon a small block which also receives wire piece which passes through bushing fastened to elevator spar. This arrangement acts as a hinge. Adjustment of elevator is made through the means of a screw which passes through nut cemented in leading edge of elevator (see plan). By the adjustment of this screw, any setting may be had with your elevator.

The rudder pivots on a 1/16-inch iron rod which extends into the rear part of fuselage. The leading edge of rudder is provided with a small piece of wire to which is inserted in a series of small holes made in the top of fuselage for rudder adjustment. Range of adjustment here is more than adequate to counteract any torque or direction in which you might wish your model to fly. Small aluminum pieces are fastened in spar of elevator and rudder to provide a reinforcement base for tail brace wire which passes through these in order to hold elevator and rudder rigid in flight. This detail is explained very clearly on the plan.

Battery Rack

This is so clearly shown in detail on plan that little or no trouble will be encountered here. The most important factor here is that the bands which wrap partially around the battery should be made so that when rubber bands are applied the tension will be strong enough to hold batteries tightly in place.

The brass clips at either end should fit tightly up against either end in order that the proper connection will be had in your circuit. The method in constructing the battery rack as shown is so that it can be moved back and forth to balance your model for flight.

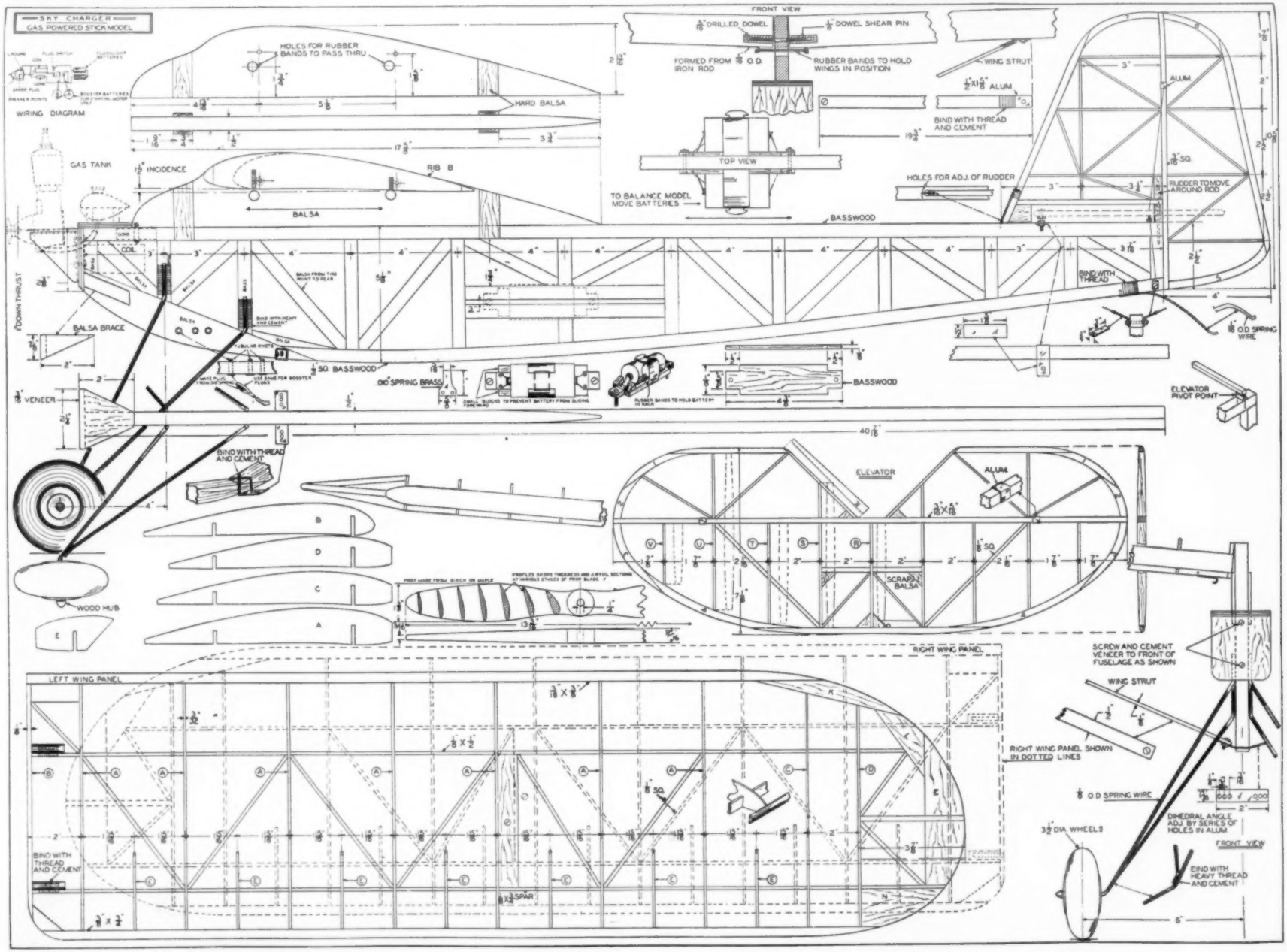
Covering the Model

The wings and tail assembly are covered with a good grade of bamboo paper. In applying the paper to the framework, ordinary model airplane dope will not do.

Ordinary cement, thinned out slightly, makes excellent paper cement. In order to obtain a nice covering job, see that practically all wrinkles are removed.

Do not stretch the paper so tightly over the frame that it will have a tendency to pull out of shape. After the various parts have been covered, dope with water. This will cause the paper to tighten over the framework. If the brush is used,

(*Concluded on page* 80)


SKY CHARGER
GAS POWERED STICK MODEL
WIRING DIAGRAM
HOLES FOR RUBBER BANDS TO PASS THRU
HARD BALSA
GAS TANK
1½° INCIDENCE
RIB B
BALSA
DOWN THRUST
BALSA BRACE
⅛ SQ BASSWOOD
.060 SPRING BRASS
⅛ VENEER
BIND WITH THREAD AND CEMENT
WOOD HUB
FRONT VIEW
⅛ DRILLED DOWEL
⅛ DOWEL SHEAR PIN
FORMED FROM ⅛ O.D. IRON ROD
RUBBER BANDS TO HOLD WINGS IN POSITION
TOP VIEW
TO BALANCE MODEL MOVE BATTERIES
BASSWOOD
WING STRUT
½ X ⅛ ALUM
BIND WITH THREAD AND CEMENT
HOLES FOR ADJ OF RUDDER
ALUM
⅛ SQ.
RUDDER TO MOVE AROUND ROD
BIND WITH THREAD
⅛ O.D. SPRING WIRE
ELEVATOR PIVOT POINT
ELEVATOR
ALUM
SCRAP BALSA
LEFT WING PANEL
RIGHT WING PANEL
BIND WITH THREAD AND CEMENT
SCREW AND CEMENT VENEER TO FRONT OF FUSELAGE AS SHOWN
WING STRUT
RIGHT WING PANEL SHOWN IN DOTTED LINES
⅛ O.D. SPRING WIRE
DIHEDRAL ANGLE ADJ BY SERIES OF HOLES IN ALUM
3½ DIA WHEELS
FRONT VIEW
BIND WITH HEAVY THREAD AND CEMENT

National Air Board Award

(*Continued from page* 48)

gational difficulties as split beams, cross winds, etc. The trainer allowed problems of approach and orientation to be studied for every airport on a company's lines, without the pilot actually having to visit every such airport in succession. Thus the trainer was a valuable adjunct to the training of the future master pilot, and to the continual fitness of the man already qualified. Nevertheless, the Board opposed further consideration of the Link trainer on the ground that it was rather an aid to training than to flying safety.

6. Airway Traffic Rules.

An alternative suggestion by Jerome Lederer for the award was the development of air traffic regulations by Earl Ward. Certainly if Mr. Ward is primarily responsible for these rules, then he has made a serious attempt to increase safety. We use the word "attempt" advisedly. Perhaps the rules are helpful to scheduled airline operation. But they are intolerably complex and most injurious to private flying. Perhaps the very best feature about these rules is that their non-observance or observance is known as a rule only to God and the pilot, and sometimes to God alone. Americans have a habit of setting up an idealistic system of laws which do not work, and using common sense to avoid the harmful effects of such laws.

7. The North American All Purpose Trainer.

Earl Southee had written in stating that J. H. Kindelberger and his associates of North American Aviation had added to aviation safety by developing a remarkably rugged and airworthy training ship in their NA-16-1P. No one disputed this fact. But to design even an excellent conventional plane was not considered to be a remarkable addition to flight safety.

8. De-Icing Equipment.

Much credit is due to Dr. Greer of Ithaca, the originator of the de-icing equipment which the Goodrich company has so successfully applied to wing, tail surfaces, etc. The dangerous problem of ice formation has been largely met thereby. But surely the award should be given to recent work. So de-icing equipment was ruled out.

9. Instrument or Blind Landing Equipment.

George B. Post sponsored equipment for blind landings as one of the most important modern contributions to safety. But it is obvious that blind landings, satisfactory in semi-laboratory experimentation, have not yet reached the stage of actual accomplishment. Many men have and many organizations have worked on blind landing systems. Pioneer credit should go perhaps to Dunmore and Diamond of the Bureau of Standards, whose splendid experiments at College Park, Maryland, in 1926 aroused so much expectation. Hegenberger at Wright Field and Doolittle under the auspices of the Daniel Guggenheim Fund for the Promotion of Aeronautics have all done much to advance this art. There were many systems, many conflicting views, but none had yet passed into current practice.

10. The Herrick Vertaplane.

In the report of a previous meeting of the Air Board, a full description of the Herrick Vertaplane has already been given to our readers. Therefore, it suffices to recall that the Herrick biplane has made a number of successful flights in which the upper wing of a biplane has been converted in flight into a rotor of excellent aerodynamic characteristics. Therefore, the Herrick design is a serious attempt to combine the efficiency and high speed of the airplane with the fine landing and landing-run characteristics of the rotor plane. Since improvement in landing qualities robs emergency landings of much of their terrors, the Vertaplane is most decidedly a step towards safety. Mr. Wilford pointed out that there were several other avenues of approach in the Vertaplane. The wing area might be cut down to the barest minimum, so that the aircraft might fly at its very best L/D ratio. A transport might be built with this minimum area. Then the wing could be set into rotation for alighting purposes with an instantaneous increase in lifting capacity. A Vertaplane might be ideal for catapulting purposes, make a forced landing in a wood quite feasible, and was the result of ten years' continuous development and personal effort by Mr. Herrick, who had moreover used freely of his own personal resources. Mr. Wilford thought that in some respects the Vertaplane paralleled the Westinghouse air brake, which had made railroads really safe. Members brought up several difficulties, however. While conversion from fixed wing into a rotating wing had been accomplished, the rotor could not be used for take-off since the contrary conversion had not yet been attained. To house four engines in a wing and then to convert the wing into a rotor offered insuperable engineering difficulties. There appeared no doubt that a worthwhile development had been undertaken, but it could not be said that there was as yet final achievement.

11. Installation of the Radio Direction Finder.

Some of Ray Brown's friends had pointed out that he was perhaps the first man on this side of the Atlantic Ocean to install a radio direction finder on his Lockheed, and that he had pioneered both the application and the adoption of this device. But it is also quite clear that radio direction finders were developed and applied by many technicians both in Europe and in the United States.

12. The Tricycle Landing Gear.

Waldo D. Waterman was in favor of the tricycle landing gear. There is no doubt that the gear has won a real place in aircraft construction. Mr. Tomlinson cited his recent experience with a Waco so equipped. He had successfully landed the machine at 90 degrees across a strong wind. With a conventional gear such a maneuver would have meant an inevitable "piling over." It was a great sensation also to be able to fly straight into the ground with the nose well below the horizon. Granting the merits of the tricycle landing gear, who really was responsible for it? Was it "Becky" Havens who had built and flown such a gear 27 years ago? Was it Farman or Bleriot or some other of the early French constructors? Was it Bill Stout with his Sky Car? Or Fred Weick with his W-1? Or Mr. Waterman himself? Or John Geisse, indefatigable advocate and patron of this development? Quite evidently no award could possibly be made for the gear.

13. The Constantin Girouette.

The Constantin Girouette, sponsored by Mr. Wood, Paris correspondent of the Board, received interested discussion. A vane ahead of the airplane receives the effect of a gust and actuates the elevator. A sidewardly acting vane increases the effect of the dihedral in counteracting sideslip. Simplicity is certainly a valuable feature of the Constantin Girouette. In effect the Constantin device increases the longitudinal and lateral stability of the plane. Flight tests have been promising.

A Vote Restricted to Three Developments.

Finally all but three suggestions were eliminated. Voting with a maximum figure of merit of 10 for each device gave the following results:

1. Rotatable Loop.....106
2. Airport Traffic Control.. 96
3. Herrick Vertaplane..... 43

Accordingly the $250 cash award and the plaque goes to Jack Franklin, superintendent of communications for TWA.

Honorable mention was allotted Earl Ward of the Bureau of Air Commerce and to Gerard P. Herrick.

END

AMATEURS ! ! !

Pilots—Designers—Builders

IF you wish to make one more attempt to preserve your liberties and the right to build and fly your own planes, sign the coupon below and send it to us so that we can make one last effort to save the lightplane situation. Your votes on these coupons will be of more assistance than any other argument that we can advance to the local authorities.

WRITE NOW — ACT NOW

POPULAR AVIATION,
608 S. Dearborn St.,
Chicago, Ill.

GENTLEMEN: I, the undersigned, wish to have the existing regulations governing amateur aviation modified so that the amateur once more has the right to fly.

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Think of it—a wonderful money-saver as well as time-saver! Cub fliers report better than 25 miles to a gallon of gas and 350 miles to a quart of oil. And the initial cost is surprisingly low—the new Cub Trainer only $1270 and the new Cub Sport only $1395 F.A.F. factory.

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COUNT THE CUBS

THE WORLD'S FASTEST SELLING AIRPLANE

Aviation on the Farm

(*Continued from page 26*)

the rancher valuable time. Many supplies are brought back to headquarters by air.

When today's veterans of the cattle and sheep ranges put their ranches on the wing, it is safe to say the next generation will include hundreds of flying cowboys who will write additional paragraphs to the chapter on livestock and aviation.

Another important phase of aviation's relation with agriculture is the shipping of farm products by air. What the eventual outcome of this chapter will be no one can tell. Today it is impossible for air express to carry crops to markets hundreds of miles away on the scale the railways do because of the bulk and weight.

Constant improvement of planes with larger capacity and power, and the fast expansion of air express, with planes given over entirely to that type of hauling is being witnessed now. In the next few years there will be greater improvements and more express planes. There will be more business and rates will go down. More farmers will then make use of this fast mode of transportation. Just how much use they can make of it will depend entirely upon developments. If an airplane can be developed that will haul many tons of fruits and vegetables and keep them refrigerated until they reach the markets, and express rates for these commodities can meet the railway cost, farmers' crops will move by air.

The farmer, even now, is using air express as much as possible. Rice growers of California, Texas and Louisiana have to compete with other parts of the world. The rice growers therefore have made special arrangements to fly their samples of rice to the buyers in foreign markets as soon as the new crops come in.

Flowers are ideal for air shipment because they are light, and so are shipped regularly from city to city and coast to coast. Samples of cotton from the southern states are distributed to buyers by air. Wool is flown from Texas, California, and the Northwest to textile centers such as Boston so the buyers may see samples.

The airplane has become the carrier of insect armies. Recently a cargo of parasites were shipped from Sacramento, to relief of worm-infected citrus groves of Florida. Coddling moth worm parasites numbering 2,000 left Yakima, Washington, last winter to besiege apple orchards in Peru.

The South American rancher makes good use of the airplane. Using air express he has imported from the United States products that would improve his farming practice. Baby chicks by the thousands have been flown to the southern continent. Eggs to be hatched and queen bees often go south by air.

The West coast asparagus, pear, apple, and celery growers know what it means for them to bring their products to the attention of the eastern city buyers. A crate or two of the product is shipped by air and the merchant places a sign on the box stating, these pears—or whatever the product may be—were picked yesterday in Courtland, California, and shipped by air. Good advertising, you will have to admit, even though the grower does not make a cent on the fruit. The growers know thousands of metropolitan shoppers will stop and admire the fruit.

Even steers that have been butchered and dressed turkeys are shipped by air for the publicity. Quite often the first of a new season's crop is sent to market by air, when there are only a few crates. Because it is the first, it commands a very high price in such cities as New York and pays the rancher to make the shipment. Strawberries from the Sacramento Valley in California and from Puget Sound, as well as loganberries from Puyallup Valley in Washington have arrived in eastern cities by air.

One of the major uses the farmer is putting the air express to today, the American Express Company officials will tell you is transportation for machinery parts needed quickly for a tractor, harvester or other farm equipment. Generally such parts are available only from the factory in distant cities. By train it would take days, by air a few hours. Often it means the difference between the saving and loosing of a crop.

One example airline officials point to with pride, is the shipment of a piece of machinery from Moline to San Francisco where it was loaded on the *China Clipper* and landed in the Hawaiian Islands just 30 hours after it had left the factory. This fast service saved the entire crop for a sugar planter.

In the work the western pilots are doing toward putting agriculture on the wing can be seen a quiet revolution in agricultural methods. Floyd Nolta firmly believes the future of agricultural aviation is limitless and should be profitable.

"You can plant any kind of a field crop with an airplane. What will actually be done will depend to a large extent upon the cooperation given us by scientists," he says. One such example is that which has been accomplished in the fight to eradicate wild mustard from barley fields. Barley has a smooth leaf; mustard a coarse leaf. There is a chemical which can be sprayed over barley fields near dawn. The dew will wash it from the barley leaf into the ground where it will kill other weeds in addition to injurious insects. It then will penetrate the land and act as a fertilizer. In the meantime it has stayed on the rough leaved mustard and kills it.

There is one ambition Nolta has which would be a great benefit to the grain farmer. During the harvesting season thousands of acres of grain is burned annually. Nolta's hope is that science can develop a chemical which will quickly extinguish such blazes.

His opinion that the future advancement of the use of the airplane in connection with agriculture rests upon the shoulders of scientists and technicians is well-founded. One of their problems is to develop a refrigeration plant or method that will not be too bulky and heavy for an airliner, which can be used to keep vegetables and fruits refrigerated. When that is accomplished a larger amount of such products will readily fly to market, and another chapter in agricultural aviation will develop to perhaps an astounding end.

END

Alloy

(*Continued from page 30*)

confused at the bond that is formed between the base metal and the plating. Not only is it highly resistant to salt spray and extreme temperature variation but it appears to ignore treatment that would quickly remove ordinary plating on the common metals. Work is now in progress to determine the real nature of this bond. In one of the tests performed, plated articles were shuttled back and forth between sub-zero cabinets with sprays kept at 140 degrees. Although the experiments were continued for several weeks, the plated articles supplied no hint of succumbing to this sort of abuse.

END

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The Birdmen's Perch

We've got a new one: Let's have cartoon ideas—any and all that may be lurking under your flying bonnets. If they are original and funny, we'll have our artist illustrate them; then we'll publish them and forward the original drawing to the contributor as a present. Like the idea? Okay . . . forward them quick, to:

MAJOR AL WILLIAMS, alias "Tattered Wing-Tips," Mgr., Gulf Aviation Dept., Gulf Aviation Products, Gulf Bldg., Pittsburgh, Pa.

AND WHAT DOES THE LEXINGTON SAY . . . ?

Dear Major: I had just left the naval station at North Island, and the Cyclone in my Curtiss Hawk was turning up nearly full gun when there was just a perceptible shudder in the plane, followed instantly by total obscurity of the windshield. After a semi-blind landing on the carrier, the mechanics had to soak the glass with water in order to remove the splotchy red-and-gray mess which contained just enough ground feathers to identify it as the mortal remains of a medium-dark sea gull. —**L. G. Domning, U.S.S. Saratoga**

REMEMBER THE CASTOR OIL DAYS?

Remember when castor oil was the *only* oil that would stand up in the engine of a crate? But remember, too, the flint-like carbon and pistons cemented tight as soon as the engine cooled?

Such an oil simply wouldn't do today.

For modern flying makes far more severe demands on oils—demands that can be met only by the very finest 100% Pennsylvania oils, refined by every bit of ingenuity available to modern science.

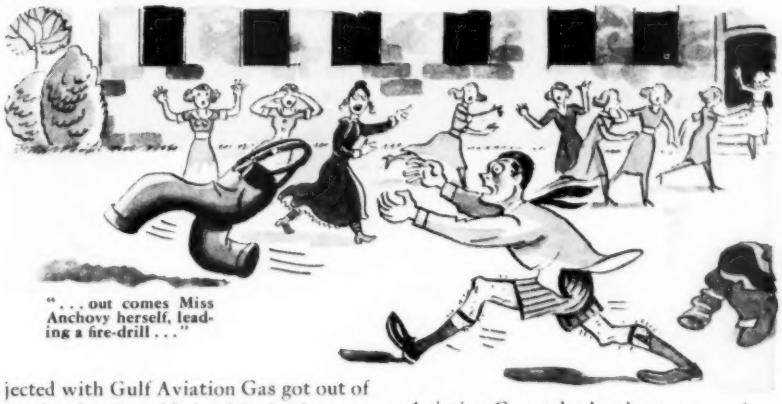
That's what makes Gulfpride Oil—refined by Gulf's patented Alchlor Process—the world's finest oil for planes. This process takes the finest Pennsylvania oil, *already* refined by ordinary methods, and still further refines it—removing as much as 20% *more* black sludge and waste.

HELP!

Can some reader help solve this puzzle?

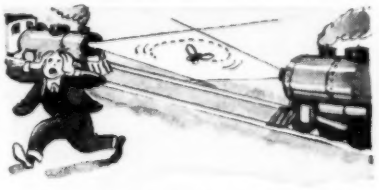
In selecting a gasoline to get the most performance out of my 5 house-fly power plant, I have been injecting selected horse-flies with doses of fuel, and then clocking their time around a circular glass tube.

To avoid unwarranted ridicule, I have been testing them at night near Flyspeck, Wash., close by the railroad track. Several nights ago one of my specimens injected with Gulf Aviation Gas got out of hand before I could clap him in the race-track, and flew out into the path of the Bluebottle Flyer, crack night train.



"... out comes Miss Anchovy herself, leading a fire-drill ..."

I discovered later that at this very moment at Blowfly Junction 150 miles away, the 25-mile-an-hour night freight was switched on the same track as the 75-mile-an-hour Flyer. After these two trains had collided head-on, the remains of my buzzing guinea-pig, still smelling of Gulf Gasoline, was found in the smashed headlights. It was supposed that he had flown back and forth from headlight to head-



light, turning instantly, until the crash.

If he averaged 200 miles an hour, like the other specimens tested with Gulf, how far did the little fly fly? —**L. G. D.**

THIS MONTH'S WHOPPER

Major, two years ago I lose a good pair of pants on account of your gasoline.

These pants are a very important part of a new suit I am wearing at the time, on a hop up-state where I expect to favorably impress a certain candy cane who is at that time an inmate of Miss Aggie P. Anchovy's Select School For Young Ladies. So when I land in their yard, I am very sad indeed that I find a greasespot.

Major, I swab that spot off with Gulf Aviation Gas and what happens . . . ?

That gas hits them pants and a shudder runs through them. They wiggle out from under me, and before I can tackle 'em they've kicked me twice in the shins and are galloping off across the campus hell-bent-for-thursday, me after them. And just as they pass the dormitories, out comes Miss Anchovy herself, leading a fire-drill.

Now Major, I never am not much of a one for admiring myself in the mirror when I get up in the morning. But when that bunch of young ladies lamps me in shorts and garters and turns around, fire or no fire, and marches back in that building . . . well, I just kiss pants good-by, and take off for parts away from there.

I never do see those pants again Major, until years later. Then one stormy night my door-bell jingles. I look out, and there, kind of tattered and sheepish-looking is that old pair of pants of mine. Standing right behind them is a long pair of lady's red-flannel woolies—and bless my soul if, clustered around them aren't six of the cutest little pairs of baby pantalettes you ever did lay your eyes on.

That's *some* gasoline, Major. —**F. A. Z.**

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF **GULF AVIATION PRODUCTS**

.... Clear and Unlimited

(*Continued from page 38*)

management can give the industry a break in the matter of cordial relations.

The outstanding feature of the entire ten days was the American Airlines dinner to the Industry at the famed "Saddle and Sirloin Club," so named, I believe, because you have to take a saddle to handle the huge steaks they serve. It was a grand party, and the blending of joyous commaraderie with a delicate tinge of *attar of cow-pen* was delightfully heartening to this old country-boy. If nothing else, it proves to me that aviation and bull-yards really go together. I hope the show never leaves Chicago.

Down-drafts . . .

For many bitter years the early barnstormers suffered beneath a choice newspaper expression used in connection with crack-ups. It was the cruel inaccuracy, "air-pocket," which clung like grease to the best of reporters' pens, from Loophole, Ia., to wise-guy New York. But nowadays journalistic aeronautical lore has advanced to such erudite lengths that they blame all accidents on "down-drafts," instead of the erstwhile "pocket."

The latest instance of this sort of lousy reporting is found in a "special" dispatch to the astute Chicago *Tribune*, proclaiming that the two Navy patrol boats collided because of a (Heaven forgive them) "down-draft." I say odoriferous reporting because, if nothing else, a collision in air cannot be caused by drafts. If a down—or up—bump hits one of the ships it is bound to hit and affect the other one identically; they'd both rise, or sink, together and *stay the same distance apart*. Therefore collision would remain a mathematical impossibility.

You know, and I know, what causes collisions—neither one sees the other until it is too late. But the point is this: The next time you see such an inaccuracy in your newspaper take the bother to call the "desk" and tell the editor about it. He may come on the wire with a surly-sounding "Hal-low" but don't be discouraged. Hop right on him and tell him that if a story is worth telling it is worth telling truthfully; that his today's paper is a liar and a dishonor to the Fourth Estate; that he should not believe every little punk space-writer on the wire services who is more anxious to make a shilling than he is to dig for facts. In short, give him a dose of brimstone and salt. That is, let him have it if he sounds surly. Otherwise explain what you think happened in an intelligent and patient manner. Do this two or three times and you'll be happy to find that reportorial inaccuracy, as far as aviation is concerned, will soon disappear from the pages of your own favorite newspaper.

A Lotta Scud . . .

Wonder if Vincent Bendix knows that Thiel College, Greenville, Pa., of which Amelia Earhart's grandfather was a co-founder, is in dire need of a few dollars to complete their "Amelia Earhart Memorial Dormitory for Women?" They are trying so hard, out there in the Pennsylvania mountains, to perpetuate Amelia's grand spirit of service. But it is a quiet little institution utterly unversed in the hurly-burly ways of the world; the dough is not rolling in so fast. . . . There is one commercial organization in this country where the employees are 100 per cent pilots. It's Harry Shaffer's Interstate Credit Corporation, in Minneapolis. (Airplane financing neatly done.) . . . It was funny when ad-man Bill (United Aircraft) Forbes told the railway ticket agent that he was flying back from Chicago and wouldn't need round-trip accident insurance. The man in the cage let out a yell and tried to climb straight through the bars.

There is soon to be an announcement about a new propeller that will set the industry back on its heels. I've sworn not to tell until they let me fly it first. . . . You lightplane owners will welcome the new Criley hydro-gas engine starter with open arms. It marks another step ahead and away from the military and transport monopoly of flying. Here's hoping that no big "soul-less" corporation will try to buy the patents in order to keep prices up. . . . Still another hopeful sign for private flying is that the insurance companies are coming around to believe that ordinary beings like you and I can fly aircraft with reasonable success. Witness the fact that Aero Insurance Underwriters, Inc., had a impressive display at the Chicago show and handed out a "Happy Landings" pamphlet containing all the symbols used in teletype and radio transmission along the Federal airways. If you want a copy write to F. N. Davey, Aero Insurance Underwriters, 59 John St., New York, and tell him that Swanee said to give you one. It's pretty dog-gone handy.

It was nice to see that Leighton Rogers and practically the same people got re-elected at the annual meeting of the Aeronautical Chamber of Commerce. They've done a grand job in the past several years. But let's hope that the Chamber's press relations won't leave the hands of Howard Mingos. Because, if for no other reason, vice-presidents are too apt to get thinking up ways and means of focusing attention on their own jobs, generally at the expense of cordial relations with the press.

END

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HOME OF THE DAWN PATROL

Marvels of the Petoscope

(*Continued from page 58*)

cerned with light-beam projectors or photo-cell housings.

Unlike the photo-electric cell, the petoscope is designed to detect a comparatively small object encroaching on its field of view, regardless of the amount of light transmitted by the background or by the other bodies within its field of vision. Unlike the light-beam set-up which resembles looking through a narrow tube and, therefore, offers a small range of vision, the petoscope model's range covers range of 50 yards are registered by it and it sees automobiles 200 yards away.

A singular feature of the invention is that a figure running is noted at a greater distance than is a figure walking. A light-colored object, is likewise ascertained much farther away than is a dark colored object, the reason for this being the difference in contrast between the object and the background.

Airplane pilots at Patco Airport, Philadelphia, Pa., assisted in experiments for the purpose of ascertaining at what height and under what conditions a plane might be distinguished. The petoscope was focused on the sky and immediately an airplane came into its field of vision, even though flying at 2,000 or 3,000 feet altitudes, the device automatically rang its bell.

A field experiment conducted with the apparatus was the attaching of a small motor-operated device to the control-box of the petoscope arranged to wave a signal flag immediately the motor was energized. A man stationed across the field from the device would wave a flag at intervals whereupon the petoscope-operated device would wave its own flag.

Without the use of elaborate diagrams for illustrative purposes, a complete description of the machine and its construction runs too obscurely into the technical. The inventor himself, however, has described the action of the machine for the comprehension of the layman, using the example of an observer standing on one side of a picket fence.

On the opposite side of the fence a man is walking. The observer sees him in intermittent flashes as the pickets allow him the view. Accordingly, light emanating from any given point in the field will be transmitted in duplicate. Likewise, the entire scope of view is presented to the photo-electric elements through specially constructed gratings arranged similarly to a mask-shaped row of slats allowing any moving object to cause continued impulses or ripples of electrical effect.

An intricate, yet comparatively simple system in proportion to its accomplishments, is arranged within the petoscope. A double-optical system is employed along with a balanced bridge arrangement holding two photo cells. Actuation, therefore, occurs only when efforts unbalance the bridge arrangement. A general level of illumination provokes no response. Pulsations in the light must occur, causing alternate unbalancing of the bridge, the frequency of this unbalancing governing the response:—no motion, no unbalancing.

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A pair of objective lenses, a pair of photo-cells and a pair of condensing lenses constitute the main part of the set-up. The objective lenses embrace the scope of view whereon an object, distinguishable by contrast to its background, moves. The light striking these lenses received by the photo-cells in nearly parallel beams concentrated onto the photo-cells by their condensing lenses.

Duplicate images of the optical scope at their respective focal planes are set up by these optical lenses. The screens are regularly divided in squares with transparent and opaque sections alternating, the divisions being exact in size and shape but whereas on one screen certain squares are opaque, corresponding squares on the other screen are transparent.

Thus, the reception of the duplicate focal points of light on the screens will, in the one instance, be stopped by an opaque section and on the other, pass through a transparent section, impinging on one photo-sensitive element or the other but never simultaneously. The image of the moving object, by alternately appearing in opaque and transparent divisions of the screens alternately stimulates the photo-cells, the distances from the lenses and the velocity of movement affecting the frequency of the alternations.

It is an important fact that when there is no movement in the field, the light reaching the photo-sensitive cells will be equivalent and steady though variations in the intensity of the illumination causes variation in the stimuli. Therefore, the bridge may be unbalanced through the amount of light received by the photo-cells and the amplifier will be affected only by a varying out-of-balance coupling. Changes in the intensity of daylight does not affect the amplifier since both photo-cells are equally affected.

Screens of a type other than the checkerboard variety are used on occasion. Those with vertical divisions of increasing width from left to right are calculated to be actuated by horizontal motion. In the case of the image of an object passing at a level speed from left to right an audible signal of decreasing frequency ensues, and vice versa.

Under certain conditions it is possible to check the speed of vehicles as well. An automobile passing along a roadway at right angles to the petoscope's optical axis will induce a signal frequency of direct function concerning the speed of the automobile. This providing the petoscope is placed at a given distance from the roadway. It is suggested, and logically so, that this principle may have important and far-reaching possibilities in connection with military or naval reconnaisance.

Yet another type of screen is affected by the deviation of free-moving objects from their predetermined path. In this case, duplicate portions of the screens are blocked out corresponding to the image of the field across which the movement is allowed. This treatment might be satisfactoritly employed in park areas where trespasses are likely to infringe on "no trespassing" laws, the alarm being sounded at the digression of the offender. An object may remain within the scope of view of the apparatus and show no motion with the result that no registering of it be made, but immediately the object begins to move its movement is recorded.

Although the accompanying illustrations furnish a rough idea of the set-up of the apparatus, further explanation may not be amiss. The upper portion of the machine comprises the optical or photo-electric head balanced within a yoke supported, in turn, by a central column rising from a movable chassis. The optical system is contained within the photo-electric head, the objective lenses being visible in the photograph. Also included in this head are batteries for the photo-electric cells and for the first stage of amplification.

The battery box attached to the rear of the chassis hold additional batteries for the remaining stages of amplification and within the forward battery box there are two six-volt batteries, one of which is maintained for the heating of amplifier-tube cathodes and one for operating various controls, signaling and relay apparatus. Obviously, the optical head may be tilted to the angle desired as well as elevated and rotated.

Utilization of the device is not confined to the out-of-doors where the moving object is a considerable distance from the lenses, but practical operation may be carried on inside of buildings as well. It is anticipated that valuable developments will be perfected after further experiments with the apparatus have been completed, insuring its use in factories where wholesale inspection of bolts of cloth and rolls of paper must take place. Cleaning and dyeing operations may also be influenced by it.

In a test set-up, wherein the petoscope was adjusted to survey a band of paper, previously marked by hand to represent defects, passed by means of rollers before the petoscope at the rate of several hundred feet per minute. The paper, illuminated by a photographic studio lamp, brought a responsive signal from the contraption as each simulated blemish came into view.

In this indoor operation, no difficulties are entertained such as occur in field work, i.e., the intrusion of free-moving objects and waving of tree branches. The lenses may be focused at the desired distance from the material which, in turn, is unvarying from its anticipated course. The objective lenses may be done away with and a simple screen composed of transverse slats may be installed directly above the material which moves in only one direction.

In fact, so varied are the possibilities of this machine and so startling the results obtained and obtainable, that having allowed the imagination to consider its future possibilities and effects on everyday life, we rank it as only one step removed from being human, as weird a contraption as a Frankenstein might have conceived. There come to mind an anecdote concerning one who having viewed the giant airplane, the DO-X, turned dazedly away with the remark: "I've seen it, and I still don't believe it!"

END

Captain Eddie Rickenbacker, General Manager of Eastern Air Lines, and a former I. C. S. student, greeted by Ralph E. Weeks, President of International Correspondence Schools, at Scranton.

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Name _____

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Gas Model

(*Continued from page 70*)

extra precautions should be taken so as not to tear paper.

Any small spraying device is an excellent means of applying the water. After the pieces have become thoroughly dry, clear dope them. To obtain a smooth finish, a light sanding is given between each coat. To finish off the model, color coats are applied.

Extra precautions are required in assembling the model as proper alignment of pieces must be obtained so that the model will fly properly. Please bear in mind that a little thought and study at this point will save you many hours of additional labor in repairing your model.

If the wings are not exactly in alignment and are not square with the fuselage or if the angles of the two panels are not exactly the same, then the model will not fly properly and will be difficult to control. Careful measurements should be made in checking up these points.

Testing the Model

By placing the fingers about ⅓ back from the leading edge of the wing you can determine whether the model is approximately balanced.

END

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J5 motor, 220 H. P. Entire ship recovered. Ten hours since complete major overhaul on both motor and ship.

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J6-5, 185 H. P. Entire ship recovered. Fifteen hours since complete major overhaul on both motor and ship.

CHALLENGER ROBIN—$790.
Motor exceptionally good. Fabric good.

TAYLOR CUB J2—$890.
Late 1936. 305 hours total time. Ship and motor perfect. Roller bearing wheels.

FAIRCHILD KR21—$998.
63 hours total time since entire ship was recovered. 18 coats with rubbed finish. Motor time 66 hours since major, new pistons, valves, springs, and all new bearings, mags rebuilt. New collector ring, carburetor heater. Steel prop. Semi-air wheels, brakes.

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RYAN B5—$2474.
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REARWIN—$1295.
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WACO SEAPLANE—$1625.
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Yukon Yeoman

(*Continued from page 38*)

up at high altitudes sometimes, even on routine weather flights.

Pilots in the States who make observation flights for the Weather Bureau escape the chore of warming up a motor as it is done in northern and interior Alaska. It's a chore that all Alaskan pilots in these sections must contend with, weather hoppers included. An hour before takeoff the motor oil is heated over a portable gas stove and a gas torch placed under the canvas cloaked motor. A never relaxing vigilance is necessary, and mighty important it is too, for every winter fires start from these torches. The fire-blackened motor and motor mounting of one of Gillam Airways' three *Pilgrims* was mute evidence of a fire from a torch the previous fall. Other Alaskan pilots have had planes burn to the ground from this cause.

Warmly built hangars would save most of this worry, but these are not always within easy reach of growing young companies, and it seems that Uncle Samuel hasn't troubled himself to worry much about the problems of his "Attic" birdmen. Not thus far, anyway.

When the last flight of the present period by the Gillam plane is made under the Weather Bureau contract March 11 (one day after this issue of POPULAR AVIATION reaches the newsstands) this airways will have completed the second winter period of the farthest north weather hop, and the second contract to be completed thereby.

The first regular period the winter of 1936-37 lasted from September 15, 1936, to March 15, 1937. During this time 316 flights were made, an average of nearly two a day. The Bankhead-Jones Act of Congress made the upper air study possible. The first period a success, the flights were repeated this past winter under a similar contract, though flights are only made every third day. In conjunction with flights this past winter, Drawbaugh, assistant meteorologist in charge of the work at Fairbanks, has been sending up gas balloons that are five feet in diameter and carry a robot short wave set. Though this gadget might be classed as a new form of competition for weather flight flyers, it is so closely allied with the study now being made at Fairbanks that it is necessary to explain it briefly.

Made to reach the stratosphere to which present weather flight planes do not go, the balloons are adding to the knowledge of upper air movements. Their "mechanical brains" automatically record and wireless their information to the short wave receiving set at the airfield. Carrying a two-pound cylinder with two-tube radio and a meteorograph the balloon ascends, into the rarified air where it bursts and its "mechanical brain" falls with a parachute to the lonely Alaskan terrain below. The Bureau offers a reward for each one found, but in the sparsely settled areas of Alaska's interior, few if any rewards are expected to be claimed. If some sourdough does get "conked" with one of the "mechanical brains" the writer is a bit uncertain to what the robot might have to report, but we know truthfully what the sourdough would say, with the usual fund of expletives many sourdoughs have.

On the other hand, if such a fall would effect a sourdough victim sympathetically, we feel sure that the fellow would have the inside track on the annual Ice Pool betting! The pot of this exclusively northern affair was more than $75,000 the spring of 1937. Help of a "mechanical brain" with its babbling of temperature, pressure and humidity should produce the correct bet of the day, hour and minute of the Tanana river break-up. But then, perhaps we are wandering too far afield.

One of the purposes of flights by the Gillam plane this winter has been to check on accuracy of the newly-developed robot balloon instruments. In addition, it takes more than a "mechanical brain" to gather the fund of information an Alaskan weather flyer must have. So probably the weather flyer's job in the future is safe.

At Fairbanks, in contrast with its longest summer day when the sun is above the horizon for 21.9 hours and darkness doesn't fall, the shortest day December 21 sees the sun above the horizon only 3.7 hours. Sunrise is at 10:59 a.m. and sunset 1:38 p.m.

During the first winter of weather flight observations when two flights were made in a day, the Gillam Airways plane ascended the height of nearly three miles to the awe-inspiring flicker of the *aurora borealis* and with the moon still bright in the sky. Robert W. Service, oft-quoted bard of the north, would have written more about the "northern lights" and their "strange sights" had he had a chance to make a flight with the weather pilot.

Incidently, there are no facilities provided for night flying from the Fairbanks field except one floodlight and an airway beacon light. No radio service is provided excepting the airways' own, which last year was made a mandatory equipment with all airplanes in Alaska by the Alaska Territorial Legislature. The Fairbanks airfield is 465 feet above sea level. Both wheel and ski equipment is used, but during weather flight periods it is usually the skiis that get greatest use.

No passengers are permitted on these weather hops because of their hazardous conditions. Many planes stay on the ground while the weather plane makes its routine trips. On these ascensions visibility observations are made by the pilot at 5,000 and 10,000 feet, and reports made on clouds or haze. Time and altimeter readings must be made when entering or emerging from clouds or haze or any

snow or rain. Under terms of the weather flyer's contract at Fairbanks weather conditions allowing delay of flights without finding by the Weather Bureau are: When the ceiling at the airport is lower than 1,500 feet, or visibility is less than three miles or unusually hazardous icing or wind conditions prevail, fuel for a 3½ hour flight is specified under the Weather Bureau contract.

Knowledge that the path of the masses of cold air from the North Pole area travel over Alaska's interior and in a general direction down to the Mid-West states prompted W. R. Gregg, chief of the Weather Bureau, and his fellow meteorologists to initiate the Fairbanks study. Remote as Fairbanks may seem to most POPULAR AVIATION readers, it is expected to prove of great value to comfort of many in northern United States sections. For this Alaskan pilot and his Weather Bureau co-worker are developing a long range forecasting by which it is hoped to accurately forecast blizzards in Toronto, Chicago, Buffalo and other points. And that, judging from unexpectedness of some recent blizzards in Eastern and Midwestern centers, does have its value!

Alaska, becoming increasingly important from a strategic point of view in aviation, will also benefit from weather study at the Golden Heart of Alaska, as Fairbanks is called. Development of flying facilities will certainly utilize results of this cold weather study. Its importance grows still more as attention is called to possible trans-polar flights with Fairbanks as their first and last important North American airport. The eyes of the flying world are looking northward.

So this outpost of Uncle Sam's Weather Bureau, the farthest north weather flyer, is a sentinel to warn us of the chill forays of winter and a pioneering of future northern weather reporting as well.

END

Wright Model "B"

(*Continued from page* 48)

per square foot or more. But—the low wing loading and the correspondingly low landing speeds were a joy in calm air. The heavy wide spread skids running well forward of the center of gravity, acted like brakes in bringing the plane quickly to rest after contact with the ground and effectually avoided any tendency toward nosing over on extremely rough ground.

It is to be wondered how many present day pilots would enjoy being perched 'way out in front of the lower wing, entirely surrounded by fresh air! It is one thing to fly while snugly enclosed within a cabin and still another to face the open breeze bobbing about and sitting on the front porch of an old time wind-jammer. But even with all her discomforts, old Model "B" reared a hardy brood of pilots that electrified the world with their daring and skill.

And, be it said, that any pilot who could master the Model "B" controls could master any other controls on earth without difficulty. At the right hand, a twist of the wrist to the right or left moved the vertical rudder right or left, thus giving directional control. Forward or backward movement of the main lever on which the wrist twister was located, warped the wings for lateral control. Thus, the right hand, by means of a small flipper handle mounted on top of the lever gave both lateral and directional control.

At the left was the elevator lever which, when moved back and forth, caused the ship to ascend or descend by flexing the combined elevator-stabilizer. Our Model "B" pilot had both hands full of controls while his feet rested comfortably on the foot-rail without the slightest responsibility. When he had nothing else to take his mind off his work, he could play with the throttle located close at hand.

And the mechanic had nearly as tough a job as the pilot for the assembly and dissembly of the plane for shipment was no child's game. The introduction of wing warping freeding into a portion of the simply while semi-rigidity was as essential in the rest of the wing structure, made this part of the work a mighty tough job.

END

Air Show

(*Continued from page* 10)

Cessna, Luscombe, Seversky, Sikorsky, Vought, Spartan, Stearman and Stearman-Hammond. In the cases of Grumman, Northrop, and Seversky, the Coast Guard and the Army Air Corps, respectively, "saved the day" somewhat by displaying those manufacturers' products. But those companies themselves did little to support the show on their own side of the fence.

Reports of success from those manufacturers who did attend the show were varied. One optimistic show official announced that 50 airplanes had been sold. Others laughed at the reported sale of a total of even ten airplanes.

As a well-gotten-up show, however, the First Annual International Air Show was far and away a worthy successor to any aircraft ever held before. Attendance (about 200,000 paid) surprised even the most optimistic. An elaborate (and expensive) stage show offset some of the more technical air show features. An outstanding feature that drew much pre- and post-show publicity was the long landing strip improvised from the Amphitheater's huge parking lot in front of the building. Most of the commercial airplanes exhibited were flown in and out, saving the exhibitors' paying off absurdly expensive union movers to cart the knocked-down ships to the show on trucks. The airline that owned the Douglas airliner, though, had to pay a full crew of idle union movers for the privilege of having its own mechanics and technicans dissemble and assemble its own airplane at the show.

END

ROYAL DUTCH AIR LINES

Super-Speed LOCKHEED 14

Powered by WRIGHT CYCLONES

Super-speed Lockheed 14 transports, powered by Wright Cyclones, are now being delivered to K. L. M. (Royal Dutch Air Lines) for its European and West Indies-South American operations—and to K. N. I. L. M. (Royal Netherlands Indies Airways) for use in the Dutch East Indies.

The new Cyclone-powered Lockheed 14 has a high speed of 260 m.p.h. These swift airliners will provide Europe's fastest air transportation. They will be used on K. L. M. routes which spread in all directions from Amsterdam serving London, Paris, Berlin, Hamburg, Copenhagen, Stockholm, Frankfort, Milan, Prague, Vienna and many other important cities of Europe.

K. L. M. will also use Lockheed 14 transports on its major service between the West Indies and South America—extending from the island of Barbados to Trinidad and on to La Guaira, Curacao, Aruba, and Maracaibo, Venezuela.

K. L. M. (Royal Dutch Air Lines) and its associate company K. N. I. L. M. (Royal Netherlands Indies Airways) is the world's pioneer airline system—extending from Amsterdam, Holland to Batavia, Java—a distance of 9000 miles.

Wright Cyclones power all of K. L. M.'s great fleets of Douglas DC-2 and Douglas DC-3 airliners. These giant transports fly from Amsterdam, Holland to Batavia, Java in 5½ days—compared with three weeks by the fastest rail-water travel. K. L. M. recently completed, with a Cyclone-powered Douglas DC-3 airliner, its 500th round trip to the Far East.

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Aviation Is My Life

(*Continued from page 46*)

studies for a gyroplane, a delicate, complex mechanism that was granted patents all over the world. The project had been acquired by the Minister of the Navy to be built in the Royal Navy yard. It was not completed, however, because of an unexpected change in the administration. I am very undecided about the gyroplane, which could never be a high speed machine, and do not know whether or not it should be developed. Never more than today has it been shown that the sole reason for flight is speed.

Gradually progressing into more difficult fields, I started studying the hydroplane. In comparison with landplanes, the hydroplane demands much more detailed study. Actually, the flying requirements of both types are about the same, but in addition the hydroplane makes particular demands with regard to the floats which differ greatly from those of naval technic because of the lightness of structure and the form necessary because of the hydrodynamic displacement reached in high speed before leaving the water.

The need of considering the maximum weight of the plane in relation to the best aerodynamic results and the consideration of the much greater displacement existing between the two extremes of floating and flying, make up a complex problem, full of irritating and contradictory demands. Good results can be obtained only by a combination of compromises.

In 1922 I became technical director for the Societa' Idrovolanti Alta Italia (S.I.A.I.) that had been given the use of the name "Savoia" by royal decree. There I constructed my first hydroplane —a single-seater pursuit plane (350 h.p.) —for that year's Schneider Cup race. It was the Savoia-Marchetti S-51. The plane took second place in the race because of damage to the propeller. It was clearly faster than the English contender, as it proved soon after by winning the world's speed record for hydroplanes in 1923, making 192 m.p.h. The S-51 had special streamlines designed for speed and was remarkable for its high finish. It held the world's record for more than two years.

There were other intermediate craft of no particular importance until my first military seaplane, the S-55. This was my principal application of the "all wood" argument. This preference, to my mind, was naturally justified in the seaplane because of its unsinkable nature even in the most serious accidents. Regarding the objection that wood deteriorates, I have given practical demonstration that the treatment I originated for the protection of the wood in the seaplane (now adopted all over Italy) makes it impermeable, incorruptible and far more durable in sea water than metals used in aeronautical construction.

The S-55 had the good fortune to be used in Italo Balbo's flight to the Chicago World's Fair and marked the tenth anniversary of a technical achievement which I maintain to be capable of still greater development. Here is a brief account of the service rendered by the S-55:

In 1926 it won 14 world awards for speed, altitude, load capacity and distance; in 1927 the late General de Pinedo with the *Santa Maria* made the first round trip Atlantic flight, taking the Rome-Buenos Aires, Azores-Rome route; in 1928 De Barros-Braga's craft traversed South America; in 1929 the late Commander Maddalena made the memorable and successful flight over the Polar regions in search for the shipwrecked dirigible *Italia;* in 1930 Balbo's first great flight was made with his squadron of 12 planes from Rome to Rio de Janeiro; and in 1933 Balbo's aerial squadron made its second great flight, Rome-Chicago-New York-Rome, with 24 seaplanes.

The experience gained with the S-55 made possible a seaplane for commercial service, the S-66, a trimotored plane seating 18 persons, with a speed of 167 m.p.h., which was adequate when it was built five years ago. The Ala Littoria fleet on the Rome-Barcelona, Rome-Palermo-Tripoli, Rome-Tunis and Rome-Sardinia lines is composed of these craft and they are highly regarded by all who have travelled by air in Italy.

A super-modern seaplane for high speed commerical and military service is at present being planned on an improvement of the S-55 design.

With regard to awards, there was another craft that followed the S-55, the S-62, a fast bombing plane that in 1926 won the world's speed record for 500 kilometers (310 miles).

When the world's speed record for unlimited distance was contended by France and Germany, I constructed a plane for Italy that won the race. Many remember it because of the attention given it at the time. It was the S-64, an "all-wing airplane," the wing being used as a gas tank of 1,100 gallons capacity. This was the first of such tanks, and was a very difficult technical piece of work.

In the history of aeronautical progress the S-64 takes a prominent part for its aerodynamic superiority and certainly merited the sharply-contested world's record for unlimited distance that Ferrarin-Del Prete won with it in the Rome-Brazil flight. In 1930 the same plane used by Maddalena and Cecconi reconfirmed its worth when the world's record for distance and endurance was established with 5095.48 miles.

This second flight may be considered historical, as it was believed to be the first time that a propeller with variable speed in flight was ever successfully adopted. I planned and constructed this propeller with the purpose of easing the difficult take-off and of obtaining maximum economy in fuel consumption.

In 1929 a commercial land type was needed for Italy's lines, as well as abroad. I then planned the S-71, a tri-motored plane of 700 h.p., with a wing area of 645 sq. ft., seating ten passengers. This craft was chosen for the overland fleet of Ala Littoria on its Rome - Venice, Rome - Tirana, Rome - Vienna, Rome-Monaco lines and, in 1931, won the world's record for altitude with a useful commercial load of 4,400 lbs. As this plane gained a good reputation and was very successful, I decided to

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construct a series of more powerful craft similar to the S-71—a cantilever monoplane with a multi-cell caisson and a welded steel tube fuselage. Accordingly, the following were built: The S-72, a trimotored military monoplane for heavy bombardment, generating 1,500 h.p., and now used by the Chinese Army; the S-73, a fast trimotored commercial plane (18 seats, generating 1,800 horsepower) used by all the Belgium commercial lines; the S-74, a luxurious four-motored monoplane (30 seats, 2,800 horsepower), used by the Ala Littoria lines on the Rome-Paris run; the S-79, a commercial monoplane seating 10 passengers that could also be used as a bomber with three engines and now, produced in large quantity for Italian aerial navigation, the S-81, a tri-motored monoplane for colonial service and bombardment.

The speed, more than anything else, indicates the stage of development of these craft and the technical advancement toward a maximum speed with the greatest useful load. The S-71 made a speed of 170 m.p.h. with a load of 4,400 lbs.; the S-72, 186 m.p.h. with a load of 1,100 lbs.; the S-73, 205 m.p.h. with a load of 7,920 lbs.; the S-74, 205 m.p.h. with a load of 11,000 lbs.; the S-81, 226 m.p.h. with a load of 7,700 lbs., and the S-79, 285 m.p.h. with a load of 7,700 lbs.

This last high speed craft represents today the greatest combination in the world of speed and carrying capacity. Compared to *The Chimera* of 26 years ago, both have the same wing area—645 sq .ft. But *The Chimera* carried 26.5 lbs. per sq. ft. of wing surface, while the S-79 carries 33 lbs. per sq. ft. The relative speeds of the two would be 46 m.p.h. to 285 m.p.h.

This enormous flying load capacity in a craft built not for racing but for normal use sums up in brief the latest developments in aviation construction. In order for a plane of minimum dimensions to carry a maximum load with the least wind resistance the engine has to combine the best conditions for high speed flying. But also the wings capable of such lifting power must be complex, carefully planned mechanisms. They are far different from the wings of the earliest airplane which in their construction were guided by an instinctive imitation of the wings of birds. The wings of *The Chimera* were built with the economical simplicity of the ribs and cloth of an umbrella, and in the S-79 have become delicate, complex assemblies of costly materials treated as one might treat lace, and functioning with the precision of a watch. The modern wing is made small in order to cut the air better in high speed; it is automatically made larger in taking off and landing, when the speed is less, and makes use of large surface or airfoils which project outward and mechanically raise the lifting power so that an increased load capacity is given as though the wing had been doubled in size.

The craft leaving the ground with all its airfoils extended for maximum surface contact with the air gains its stabilizing speed as soon as it is in flight. The landing gear lifts up and is enclosed in the body. The airfoils reenter, the forms become linear, smooth and fluid, and the craft, as though withdrawing into itself to become more slender, cuts the air with its lithesome body spread out on its wings gracefully.

In November, 1933, the S-79 was awarded six world awards for speed, 621 and 1,242 miles, carrying a useful load of 4,400 lbs.

Craft of this kind, when put into military service, upset all previous ideas of aeronautical tactics. An aerial bombing squad of S-79's could cruise 1,242 miles with more than a ton of bombs each. No modern pursuit plane could ward them off. Their speed is such that approaching bombers would not be detected until they had safely passed by the outlying patrols. Since they can climb to an altitude of 22,000 ft., they cannot be seen, and thus make anti-aircraft guns entirely useless.

The S-79 is in fact the very weapon which apocalyptic prophets have declared would be used in the next exterminating war and against which there would be no defense. Since my own work has been in the direction of these terrific visions, that they may become true horrifies me. From its much-ex-

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tolled worth as a new achievement of man in science, from its being a means of bringing closer the world's population, the profoundest change in the relations between peoples has been effected by the airplane. Unfortunately it is also a weapon that can be launched from the sky with deadly effects. It destroys all boundaries; and the heaviest cannon are nothing as compared to this plane which, loaded with bombs, has a range of 1,242 miles, and that necessitates the revision of all weapons of war.

I have given the better part of my life to aviation and, looking back over my work, I feel that the spirit alone would never have been enough for all that has been accomplished if the Italian government with its energy and stimulation had not given such great recognition to aviation.

And today I may well be thankful that I have been able to contribute to the forging of the most modern means, bringing closer together the peoples of the world, both in distance and in understanding, and I fervently hope that my airplanes will never again have to be used to sow the seeds of death,

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Leading Bangup Lady

(*Continued from page* 14)

then thrilled, to see not the lanky hardened Captain Frakes step out of the inferno, but a little wisp of a girl with honey-colored hair. From that day on Jean De Luca has been something of an idol.

The airplanes that Jean and Captain Frakes crash are old about-to-fall-apart ships that Frakes buys from the owners as he finds them. Once the purchase is made, Frakes goes over the ship carefully and reinforces it in just the right places so that it will hang together until it hits whatever he or Jean will fly it into. Doing this kind of "flying," Jean and the Captain have crashed several hundred ships in more than 30 states. It is these daredevils' firm belief that their particular method of getting airplanes is doing aviation a great favor in general. They buy all the old wrecks standing around local airports and fly them just long enough to smash them to bits. On the other hand, Captain Frakes believes, these old ships might be purchased by some inexperienced youngster who can't afford a good safe ship. These fellows, Frakes insists, would naturally be taking their lives in their hands every time they tried to fly the dangerous old wrecks. Washington politicians in the Bureau of Air Commerce, however, have attempted to curtail Frakes' "liquidation" of this obsolete equipment. Notwithstanding, though, Frakes and Jean De Luca are still crashing 'em.

One of the few times Jean De Luca has actually been injured in one of her stunts occurred recently while she was driving her car through the "Broad Jump." The car roared up the inclined platform, off the end and over the roof of the parked car. But she was going so fast that the car flew far out into space (one of these daring auto-jumps of Jean's has been measured at 74 feet) and came down nose first. Instead of landing hard on the car's wheels, the car hit squarely on its nose.

But even that violent, devastating crash didn't deter her. She was back the next day with a patch over her left eye which had been cut. She also had badly bruised knees and an injured hand.

Obviously, Jean De Luca is a very unusual girl. But that is only in her work. At home, she is a normal youngster who loves dogs and horses. When interviewed, Jean was looking forward to a winter of skiing and ice skating "up in Montana where I'm going to spend the winter or bust."

We recently lost track of Jean for a while and can't report on how she spent the winter. But we do know that this dashing young girl is back at her business of scaring the wits out of people daily. The other day she was reported as having driven a speeding car over "50 sticks of dynamite which exploded under the weight of the car as it roared over them."

Personally, we'll leave that sort of shenanigans to those high-priced stunt boys out in Hollywood. And Captain Frakes apparently can't be talked out of letting his blond little stunt-girl go through such dangerous maneuvers. But then they probably don't think much of their antics in the same way we as outsiders do. The kind of a man who was among the first to stunt a tri-motored Ford airliner couldn't be expected to classify a flying collision with a barn as dangerous.

END

Shadow Shading

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Explorations

(*Continued from page* 36)

the entrance of the Grand Central Palace which measured 8'x8' each in size. This was a direct enlargement from a 7"x9" negative, and the murals showed no emulsion grain and no loss of contrast.

Hence, it may be readily seen that today, the up-to-date engineer may order any area surveyed from the air to a scale of say 1"-1600' on the negatives and then have delivered to him enlargements to a corrected scale of 1"-200'.

This gives a true engineering service which may be delivered in a period of days instead of months with one hundred percent detail plus accuracy and economy.

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Therefore, in summary, let us state that the engineer who has always been the shock trooper for the advance of civilization and colonization, today truly surveys from the sky and Icaurus has been reincarnated.

END

Fishing with an Airplane

(*Continued from page 66*)

Sam's men of the sea to start searching for the unreported plane. Just a small craft, it is thought the Savoia could stay afloat for several hours if forced to descend at sea. A rubber liferaft was carried in the plane's equipment. So were flotation cushions, emergency rations and water supply.

The little Savoia, economical in upkeep and operation, is ideally suited for this sort of work by the local sardine industry. Elsewhere conditions will vary of course, but sardine scouting along the Pacific coast does not call for a widespread cruising range on the part of the scouting plane—not in San Francisco waters, at any rate.

Research has proved that in northern California the most successful sardine fishing is carried on about six or eight miles offshore. There is none at all beyond the 100-fathom deepwater limit, according to S. H. Dado, of the State Fish and Game Division. Beyond that depth there is very little plankton, or plant life, to supply sustenance to small fish. Sardines live close inshore where the sunlight normally penetrates to the ocean floor and marine plant life is plentiful.

Sardine fishing is one of the lesser known American industries. It is not one of the least of them, however, for a season's catch in California waters alone may run to 750,000 tons. And that's a lot of fish for anybody's market!

An industry that size may well offer aviation unlimited possibilities in its further development. About 200 sardine boats operate out of San Francisco in season. Some are scattered along the Embarcadero while in port. Most of them, though, tie-up at tourist-gaping Fisherman's Wharf, with its forest of slender masts and bobbing boats, its tangle of nets and its pipe-smoking net menders.

Catches vary at different times in the season. In large measure they are dependent not only upon the volume of fish to be caught, but on the run of the tide, the brightness of the moon, and on weather conditions in general. Old-timers, the salty tang of the sea beaten into their wrinkled faces, can squint at the moon and tell you in advance how much luck the night will bring. When fish are plentiful some of the boats bring in cargoes ranging from 140 tons upwards to 220 tons each. Under such loads the boats are no longer seaworthy. Loaded down to the gunwales, with sterns awash, they often ride into port on the incoming tide. Sometimes, with heavy seas rolling through the Golden Gate, some of the precious cargo must be dumped overside to restore the boat's seaworthiness. Owners of the individual craft will take that chance for theirs is at best an uncertain calling.

Even at the best of times as many as 50 boats out of the 200 employed in the industry will return to port with empty holds. Still others will return with cargoes too small to pay for the gasoline used on the night's run, far less pay the wages of the ten or eleven men in the crew. It is in an attempt to remedy this economic uncertainty that the sardine industry intends to experiment still further with their scouting plane. And as the California Sardine Products Institute points out, the preliminary tests of last December hold out encouraging hopes for the future. Above all else, it has been definitely proved that the sardine can be spotted from the air. Their phosphorescent trail is easily picked up by air observers under suitable weather conditions.

The San Francisco sardine industry hopes that the plane will serve still another purpose if it becomes permanently employed as a scouting aid to the local fleet. Equipped with first-aid and ambulance facilities, it can render aid to injured or sick fishermen at sea with very little delay.

In the past larger vessels in the fleet have often been called upon to go many miles out of their way to render aid to members of the smaller craft. A plane can render this service more quickly. In cases of real emergency it can speedily fly injured or stricken men to shore. There is added merit in the obvious fact that they can be taken shoreward by plane with far more comfort than is possible in a wave-buffeted, gasoline-driven fishing boat. That's another advantage—and a worthwhile advantage

It's something to ponder, the prospects that have been opened up for aviation and fishing by those pioneering scouts of the West coast, Charlie Garniere and Dud Williams.

END

Kites for Clippers

(*Continued from page 64*)

start and is strong enough to carry a substantial load. It has solved radio-communication conundrums which even had the National Broadcasting Company stumped for a considerable spell. The broadcast description of the sun's eclipse last June from the middle of the Atlantic Ocean would probably have never occurred but for the kites loaned by the Pan American Airways. The kites carried the antennae high enough so that the radio signals could be speeded to the remote land over a vast expanse of sea.

END

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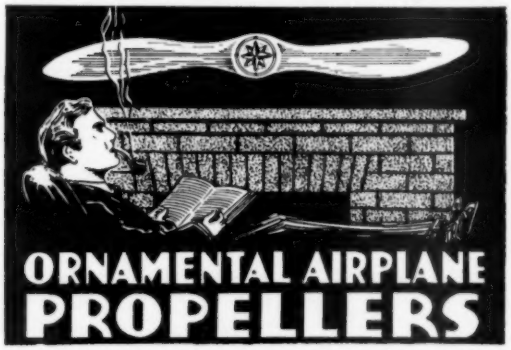

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Selection of Airfoils

(*Continued from page 68*)

index to the effectiveness of the wing. The L/D of the Clark Y section is only .3 higher than that of the N.A.C.A. 2415.

(4) Thickness in per cent of chord at 15 and 65 per cent are given to show what spar depths are available. Spar depths available in the N.A.C.A. 2415 section are about 7½ per cent greater than in the Clark Y.

It is desirable, both for balance and structural considerations, to have as small a travel of the c.p. as possible between the high and low speeds.

For the reason that both these sections have small c.p. travel, I did not work out their travel as a percentage from maximum forward position and ¼ maximum C_l. But if you care to do it, you will find the N.A.C.A. 2415 section is slightly superior to the Clark Y in this respect also.

One more point, fellows, should be taken up before we finish, and that is wing incidence. At high speed if our section has too much lift at 0 angle of attack, we must then fly at a negative angle of attack. To keep from having our nose down at high speed, we can give the wing incidence.

We can easily determine if we require incidence for our section. Knowing the weight of our plane, wing area, and speed, we can find the angle of attack required to fly at 90 m.p.h. Using the formula $L = Ky\ A\ V^2$, we solve for Ky required to fly at 90 m.p.h. We then change Ky to C_l. Looking at our airfoil characteristic curve, and knowing the value of C_l, we can easily determine the angle of attack.

For example, we will find whether the N.A.C.A. 2415 section requires incidence. Using our formula $L = Ky\ A\ V^2$, we can solve for Ky, which is:

$$Ky = \frac{L}{A\ V^2} = \frac{525}{109 \times 90^2} = .000595$$

Changing Ky to C_l: .000595 / .00256 = .2322 C_l.

Using our N.A.C.A. 2415 airfoil curve, we locate our point on the curve which corresponds to a lift coefficient of .2322 and reading downward, we find our angle of attack is +1½ degrees at 90 m.p.h. From this we can see that we do not have to give any incidence to our wing.

Incidence, the angle of the wing with the center line of the fuselage is controlled by factors involving the structure rather than lift or drag.

If our calculations had shown it necessary to fly at a negative angle of attack of —1½, we would have set our wings to 1½ degrees of incidence. If for some reason you did not want to give your wing the necessary amount of incidence, you would have to fly your ship nose down at top speed.

END

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(*Continued from page 60*)

be restored to its straight line level flight (Sec. 7). In case the airplane is left in its wing-down position, the resultant of the weight and lift will sideslip the plane and if the side force is aft of the c.g. the airplane will stay in this yawed position and with wing-down will continue in a circling flight.

This circling airplane will create a centrifugal force that should give a resultant with the weight to be parallel with the gravity line of level flight; this condition will be necessary for the comfort of the passengers. The off-set lift and the side force will put the whole force system in equilibrium (Sec. 8).

The just mentioned offset lift force is caused by the difference of the angle of attack on the inside section and on the outside section. The greater lift on the inside part of the wing is due to the larger angle of attack. This condition will be reversed if the ratio of the radius of turn and the span is small, or the angle of attack on the inside section is larger than the angle of maximum lift; this will tend to give the plane a closer and tighter spiral (spiral instability) (Sec. 9).

Spiral instability may be eliminated by sloping the wings upward, by giving them a dihedral; the larger the dihedral the greater is the restoring force.

However, there is a practical limit; dihedral up to 10° does not change the characteristics of the wing. Tests have shown that the same restoring forces may be effected by having only the quater-span in dihedral (Sec. 10).

Circling flight can be made by flexing the vertical surfaces or hinging part of it. The most efficient design will be to use 40 per cent for the rudder. In case a model is tested in a wind tunnel, the rudder design should balance all yawed conditions by having the same rudder and yaw angle (Sec. 11).

Further investigations show that the vertical tail surfaces and the dihedral angle are in close cooperation. Too much fin area puts the plane into a spiral dive, not enough vertical tail area makes the plane skid or may give the plane a "Dutch-roll." Then, again, not enough dihedral makes the plane spiral and dive and too much dihedral makes it skid. The diagram in Sec. 12 shows the influence of the dihedral and the area on a specific airplane.

The vertical tail area should also be large enough to prevent the plane from ground looping. This also depends on the location of the wheels and the use of skids or tail wheel.

Meager research data on directional stability is the reason for using an independent vertical control surface. It is known that with well-designed airplanes rudder is not necessary in the air, especially with streamline-section wing tip ailerons. But rudder is required in getting out of a tight situation.

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TRI-STATE COLLEGE

Visigonometry

(*Continued from page 56*)

These two characteristics are maintained in a projection known as the "Lambert equal-area projection," an equation proving that the total area of the spherical surface (or polar cap) is equal to the total area of the chart. The equal-area projection, therefore, preserves the area ratio as a constant.

In drawing the graphic picture of the angular measurements, a projection made from a single point is first drawn on the chart in dotted lines to assist in interpreting the chart. The binocularity correction is then applied and the resulting figure is drawn in solid lines. The blind regions are cross-hatched and the transparent surfaces are properly represented in the final chart.

Beside plotting the outline, photographs of the plane and any general information necessary to fill in the complete form are obtained. Because of variations in the paper used, slight variations in the size of the chart are sometimes found, although it has been determined that the maximum variation in radius is a plus or minus one per cent and that the area of the form is correct to within plus or minus one per cent.

On the whole, the "visiometer" has proved to be a practicable aid in measuring the field of vision from the cockpit of the pilot. The instrument is comparatively light and, hence, not difficult to transport. It is easy to set up and easy to operate. The mirror facilitates sighting with little movement on the part of the observer. True, in some cases, depending upon the size of the plane, location of the cockpit, entering steps, wings and type of cockpit enclosure, the instrument has sometimes been found inconvenient and occasionally uncomfortable to reach after it has been mounted in the cockpit. Further experiments may overcome these difficulties.

When making these tests only the so-called "normal" positions of the pilot's head were considered. While it is obvious that other positions are possible and sometimes desirable, it is hoped that the airplane of the future will be so arranged as to give the pilot the maximum desirable view with no inconvenience or unnecessary movements on his part.

Therefore, in measuring the view from present planes the aim was to determine what can be seen from such normal positions and, thus, what improvement could be effected, rather than what can be seen from unusual and uncomfortable positions.

In presenting these data graphically, a chart may be made for each of the four normal positions or the data may all be combined into one chart for purposes of direct comparison. In either case, it is believed that the "visiometer" method of angular measurement and consequent graphic charting represents reasonably the view obtained by the pilot and permits more rational comparisons of the relative merits of various airplane arrangements than has heretofore been possible. The method may be extended to include the rear-hemisphere or any other observation point as well as the fore-hemisphere.

Furthermore, the method is adaptable for use in rating fields of gunfire as well as the field of view of photographers and observers. In any event, the plotting of the forward-hemisphere view from present airplanes should bring about a more definite understanding of field-of-view requirements and thus be a contribution to improved safety in flight.

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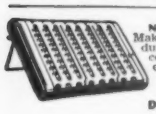

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Man Under the Hood

(*Continued from page* 42)

Coming into Chicago recently, carrying a load of War Department politicians to the Air Show there, the pilots twice overshot the 5,000 foot east-west runway before getting the plane down . . . Maybe that gives you some idea of how practical the machine is now.

* * *

FLASH! Frank Hawks is going back to speed flying . . . it's very, very hot off the griddle that the famous airman is interested not only in Gwinn *Aircars* (which he sells) . . . as I write this, Hawks is out at the Bellanca factory at New Castle, Delaware . . . he's getting set for what is believed to be a non-stop round-the-world refuelling flight . . . the ship is the special trimotored long distance racer originally designed and built for Capt. Alexander Papana, the Roumanian ace . . . Papana was to have flown the ship across the Atlantic in that infamous air race from New York to Paris in honor of the anniversary of Lindbergh's flight . . .

Anyhow, Hawks is said to be making preparations for the long non-stop hop . . . who will do the refuelling in various parts of the world, we haven't been able to dig out . . . looks like the summer's aviating has started early. . . .

* * *

Take my word for this . . . Howard Hughes will *not* make that round-the-world flight with the Sikorsky S-43 he had built for him . . . Seems he's changed his mind about flying that ship, now that it's been completed and tested . . . They say Hughes is willing to listen to a cash offer for his shiny new amphibian . . . But remember this: unless something drastically unforeseen turns up, Howard Hughes *will* make that round-the-world flight . . .

* * *

That Northwest Airlines business is a terrific kick in the teeth for them . . . Few newspapers knew what the real reason was for the Bureau of Air Commerce grounding that company's passenger-carrying activities temporarily . . . but by the time this gets on the newsstands passengers should be flying the Chicago-Seattle line again . . .

It all came about after Northwest's heart-breaking accident up in Montana a few weeks ago—the company's first in 10 years of no-passenger-fatality flying . . . The federal spotlights were focussed on Northwest's operations as a result of that crash . . . Apparently, the Bureau of Air Commerce inspectors saw things in Northwest's maintenance department that demanded action . . . Anyhow, the Bureau exercised its authority and banned all passengers from the airline shortly after the Montana crash . . . More informed circles, however, insist Northwest was the goat of rotten politics . . .

END

Airy Chat

(*Continued from page* 9)

and interesting departments and have materially increased the size of its editorial contents.

We have retained all of the popular features formerly incorporated in the old magazine and have added a tremendous amount of new material that will be the delight of the radio bug and the radio industry alike—just as POPULAR AVIATION has interested the amateur and professional in aviation for so many years.

* * *

RADIO and aviation have many interests in common and it was our appreciation of this fact that led to the purchase of RADIO NEWS. As a matter of fact, radio and aviation are interdependent, one upon the other, and it is therefore essential for the aviation student to acquaint himself with the principles and development of radio in all of its branches. Every reader of POPULAR AVIATION should also be a reader of RADIO NEWS, where the various items of radio equipment are described in more detail than possible in this magazine.

We have two articles of particular interest to the young hopeful in the coming issues of RADIO NEWS. First off is an excellent article dealing with aviation radio as a whole and as a promising field of endeavor for the aviation enthusiast. Second, is an excellent article of a semi-technical nature dealing with radio systems. We're sure that you will like them both and will profit through the pages of RADIO NEWS.

* * *

IT APPEARS, from reports published by the public press that we have at last, an actual case of an airplane struck by lightning. Previous to this incident, the reports have been in the nature of hearsay—passed on from prevaricator to prevaricator, until the whole story assumed a rather fishy odor—interesting but doubtful.

It seems that the incident, just reported, occurred during the flight of a British Imperial Airways plane. The plane was not damaged, but a few characteristic zig-zag scorch marks recorded the stroke on the polished metal shell of the ship. According to the chief officer, there was a blinding flash, a terrific roar and a ship load of badly frightened passengers.

As a matter of fact, this was probably only a "capacity flash" or side-flash from the cloud due to the condenser plate reaction of the plane. When flying beneath an electrically charged cloud, the all-metal ship acts like one plate of a condenser, with the cloud as the other plate, so that a spark will pass from one plate to the other when the distance between them is sufficiently reduced.

This capacity spark, however, is a faint and feeble discharge compared to the full volume discharge that takes place from the clouds to earth and it is doubtful whether it would have been possible to withstand an earth stroke because of the heavy current that accompanies this discharge.

Based upon its effect upon various metal parts that have been struck by lightning, the momentary current flow has been estimated variously at 2,000 to 40,000 amperes and for the thin metal skin to withstand such a load as this seems nearly impossible.

* * *

THERE seems to be a strong popular reaction toward the Diesel aviation engine by the daily press, radio commentators, etc., despite the fact that these engines have not proved out in the past—at least in the United States.

However, the pro's base their sentiment upon the fact that Diesel engine oil is not as inflammable as gasoline and, therefore, they believe that the safety element should outweigh any deficiencies in mechanical operation. Most of the newspaper arguments are based upon the death of Captain Musick, who went to his death, according to witnesses, in a burst of gasoline flame.

* * *

WHICH calls the fact to mind that more attention should be paid to the matter of fire hazard by our experts who, at the present time, are wearing themselves down to the bone in an endeavor to perfect instrument and robot flying. It might be well for commercial operators of flying boats to pay heed to the experiences of the navy with this type of equipment.

* * *

See you next month.—J. B. R.

Make It Invisible!

(*Continued from page* 63)

burners. If you think your cluster of small helium balloons is so hot, suppose you look at something we have in the next room."

The door was marked "RESEARCH—NO ADMITTANCE"—but the Colonel took a key out of his pocket and the two men went inside. On the floor were many small packages, of light weight, and a few which seemed heavier.

"The heavy packages," explained the Colonel, "contain oil-burner torches. We send them to the front on motorcycles. In each small package is a balloon envelope segment made of a light transparent material. It is something like cellophane except that it is reinforced with threads running through it."

"What is the good of a lot of balloon parts?" asked the Captain. "By the time you sew them together the war'll we over."

"You forget about the zippers," said the Colonel, "and there is one on each of the edges of the segment. When the men reach the front area, each man opens his package, and we simply zip the segments together. All we have to do after that is to attach an oil burner, and send up the observer. The balloon takes on the color of the sky, because it is made of transparent material."

"I can see through that," said the Captain of the Sky Raiders.

"So can the enemy," grinned the Colonel, "that's why they can't see it."

END

WITH THE ICE PATROL

Huge, silent, drifting icebergs, though the greatest hazard to ships in the North Atlantic, are among the most beautiful and exciting photographic subjects that a bountiful nature provides. Lieut. Comdr. N. G. Ricketts, U. S. Coast Guard, presents a vivid story of his thrilling experiences on Ice Patrol duty . . . supplemented with sensational pictures caught by his camera lens.

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CELLULOID
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1/2x 3/4x 6 6—5c
3/4x1 x7 4—5c
3/4x1 x 8 3—5c
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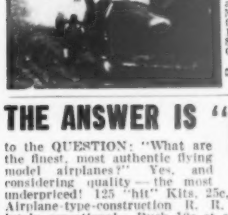
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Diesel Engines

(Continued from page 62)

the cylinder in a swirl. This aids materially in clearing the cylinder of burnt gas. When the inlet ports close, the initial pressure on the cylinder is about 26 lb. per sq. in. The centrifugal compressor is driven from the lower crankshaft through a step-up gear and safety clutch. At the end of the compression stroke, the pressure within the cylinder is about 540 lb. per sq. in., and the maximum pressure attained during combustion is around 1,050 lb. per sq. in.

In normal position, the cylinder axes are in a vertical plane. A novel mounting system is employed, the engine being entirely overhung upon light struts connecting four points on the engine to the airplane fuselage. This affords excellent accessibility, and the engine may be overhauled without removal from the airplane upon the removal of the covers at the top and bottom of the cylinder block.

The cylinder block or main case is cast of silium, an aluminum alloy containing a high percentage of silicon and having a specific weight less than pure aluminum. The working surfaces of the cylinder sleeves which are fitted in this block are completely surrounded by the cooling medium, and in some of the Junkers designs a fluid coolant also was provided in the pistons to assist in the transfer of heat from the heads to the skirts.

The gear train between the roller-bearing crankshafts, which is arranged at the front end of the block, consists of five gears. In some models the center gear drives the propeller shaft, but generally the one next to the crankshaft gear at the top is used. The latter arrangement provides better visibility and a low center of gravity when the engine is installed in an airplane. It should be pointed out that the inlet ports are uncovered by the upper pistons and the exhaust ports by the lower pistons. Starting is accomplished by compressed air.

The first aircraft design built by Junkers had four cylinders and was said to deliver 200 h.p. at 1,000 r.p.m. for a specific weight of 3.5 lb. per h.p. Two more designs, one of six cylinders, were built and tested for many hours on the block, but never installed in an airplane.

The fourth design, called the "Jumo 4," was flown successfuly for many hours. This engine had six cylinders giving a total displacement of 1,737 cu. in. and developing 500 h.p. normally, and 650 h.p. as a maximum at 1,620 r.p.m. The propeller speed was reduced to .694 that of the crankshaft, and the weight was 1,815 lb., exclusive of a propeller hub weighing 37.5 lb.

A refined version of the above engine became known as the "Jumo 204." It was rated 750 h.p. at 1,800 r.p m., and it weighed 1,654 lb., or 2.21 lb. per h.p. The respective fuel and oil consumptions were .370 and .022 lb. per h.p.-hr. The overall dimensions were: length, 57.36 in., width, 20.08 in., and height, 60.79 in.

A smaller engine called the "Jumo 5" appeared in 1933, and this model had the propeller driven from the center gear. For a displacement of 1,413 cu. in., it delivered 420 h.p. normally, with a maximum output at 2,100 r.p.m. of 540 h.p. The propeller speed was reduced to .6 and, without propeller hub, the engine weighed 1,090 lb., or 2.6 lb. per normal horsepower. Incidentally, a compression ratio of 17 to 1 was employed in this design.

An improved version of the above engine, which has a rated output of 600 h.p. at 2,200 r.p.m., became known as the "Jumo 205." This engine weighs only 1,147 lb., or 1.91 per h.p., which is perhaps the first instance of a Diesel engine having a specific weight under two lbs. per h.p.

It will be seen how this characteristic design of the Junkers engine, together with improved structural materials, makes it possible to overcome the high basic stresses of the Diesel type and yet to bring the total weight down within practical limits. And while 1.9 pounds may seem lighter, further reduction was possible.

It was in 1936 that Junkers began the development of the "Jumo 206," which was to be a lighter and more compact design to replace the "Jumo 204." It has a lower stroke/bore ratio and therefore is capable of higher rotational speed. It was claimed that an output of over 1,000 h.p. would be delivered for a displacement of approximately 1,524 cu. in., and that the specific weight would be only 1.39 lb. per h.p. These are most unusual figures, especially for a Diesel engine, but they lack official confirmation at the moment and we only quote these claims in order to convey some idea of how great has been the progress in this development.

If one compares the specifications given above with those of other Diesel engines developed for aircraft use, he will note immediately that the Junkers designs are among the leaders in this particular field. Credit is due Professor Junkers and his associates for having adopted a two-stroke principle which is simple and fundamentally sound from an engineering viewpoint, and continued in its development. Too often engineers either become discouraged or diverted from basic principles when the job before them requires years of constant effort. That the Junkers firm has succeeded in the task which it undertook is attested by the fact that two other prominent European engine manufacturers have taken licenses under the Junkers patents. One is Compagnie Lilloise de Moteurs, a branch of the well-known Peugeot firm of France, and the other is D. Napier & Sons, Ltd., of England.

END

Van Orman

(*Continued from page 68*)

parade on his return from France. It was an ambitious undertaking for those early days of ballooning, to try to reach an objective four hundred miles away, but we were brave and young and optimistic. We used a 35,000 cubic foot balloon and stored in its basket all of our instruments and scientific equipment designed for the next National Air Race.

"We left Akron late in the afternoon, and sunset found us floating over the mountains of Pennsylvania. It was the night of a full moon and we soon became so enamored of the scenery that we completely forgot our navigation for awhile and towards morning we suddenly found we had lost our bearings. We knew roughly that we must be somewhere in central Pennsylvania, but we wanted to check our course.

"In such cases before, we had always sighted some farmer and had asked him where we were. The usual reply had been 'you're eight miles north of such and such a town, and then we could plot our course accordingly.

"But in this instance it didn't work. We were drifting noiselessly three or four hundred feet above a farm, and we saw a farmer stop milking, put his milk pail aside, look around for a minute and then start milking again, as we shouted, 'Where are we?'

"We shouted louder, thinking he might be deaf. This time he stopped milking again, put his pail down, walked around the barn, peered into the door, and finally stopped in the doorway looking absolutely bewildered.

"Once more we shouted, 'Where are we?' and added, 'Look up in the air.' The farmer looked up, his jaw fell, and a knowing smile broke over his face as he answered, 'Boys, you can't fool me. You're right there in that balloon basket.'

"While this source of information proved absolutely hopeless, we did eventually fix our position and sailed on blithely, till fog rolling in warned us that the Atlantic was not far ahead, so we dropped down and landed on the Lackawanna Railroad near Andover, New Jersey, 30 miles from New York. And we saw General Pershing's parade in spite of the simple farmer in the Pennsylvania hills!"

EDITOR'S NOTE. This page out of Van Orman's diary, will be followed by others equally interesting. Van Orman's long experience in ballooning, both military and civil, and the fact that he was a winner in a past Gordon-Bennett International balloon race makes this feature both interesting and authentic.

It is to be hoped that amateur ballooning will again become popular because it has many attractive features not experienced with the airplane. It is a thing aside from aviation with an interest all its own.

Geodetic

(*Continued from page 69*)

area devices, many types of which are at present under development. The exclusive employment of elementary structural sections makes for extreme simplicity of design with consequent economy and facility of production. The inclusion of further desirable features such as inspectability, simplified maintenance and the higher degree of corrosion resistance which is made possible through the employment of open structural sections, predict a promising future for geodetic construction in the aeronautical field.

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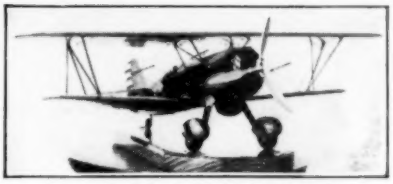

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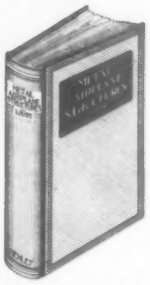

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Putt-Putt Potentate

(*Continued from page* 54)

by-side airplane, something like his present Taylorcraft. They called it the Taylor *Chummie*, because it was so chummy with two persons sitting side-by-side.

On the first flight of the *Chummie* Gordon Taylor took it up with a passenger. The passenger "froze" the controls at only 150 feet and the *Chummie* came writhing down in a dizzy spin, burying its nose. That was the end of the first *Chummie*, Gordon Taylor and the passenger.

Overcome as he was with grief over his brother's death, Gilbert Taylor wouldn't give up. He had a lot of faith in that *Chummie* design.

So he canvassed relatives, friends—anyone he could find—seeking to raise enough money to continue. Finally, a wealthy Pennsylvania oil man supplied the necessary backing and Taylor moved to Bradford, Pennsylvania, setting up a little factory to build *Chummies* for the market. They were not a success. They flew all right, but they cost too much—$3,985—and youth of the kind Taylor wanted to reach couldn't afford such extravagant sums. Then came the depression that definitely ended the *Chummie*.

Taylor built some gliders, one of which made 600 successful flights, but his real love was the motored airplanes. His experiments with gliders convinced him that practical airplanes, much safer and more economical than those built previously, could be built and flown successfully.

In 1930, he came out with the first Taylor *Cub*. And that was a feat. Remember, the Bureau of Air Commerce by that time had attained a lot of powers. The Bureau didn't then—as it still doesn't—look with much favor on the airplane builder who hadn't a lot of financial backing. They required stress analysis, flight tests, more flight tests, more stress analysis—enough red tape to discourage the ordinary airplane builder—but the *Cub* came through with flying colors. Incidentally, that first *Cub*, after flying scores of thousands of miles in nearly eight years, is still putt-putting along, as airworthy as ever.

The *Cub* was an instantaneous success. Flying instructors liked them. So did the students, particularly because they were so easy to fly and so cheap to operate. The depression did its worst, but there was a tremendous demand for the *Cub* and the Bradford factory prospered. Addition after addition was built—until the wooden factory was sprawled all over the field—but build as many additions as it would, the company couldn't keep up with the demand.

In 1935, Taylor, his health broken, was forced to leave the company to go back to Rochester.

Control of the company slipped out of his hands and, when he recovered his health, he found himself virtually where he had started—with nothing. But Taylor wasn't an easy guy to lick.

"I made a start once," he vowed. "I'll make another."

With little capital, but with a grim determination, he shut himself up in a hangar at the huge Butler airport, 22 miles north of Pittsburgh, and went to work with welding torches, a pile of spruce, a few rolls of fabric and some cans of dope.

The result was the Taylorcraft. Retaining a lot of the *Cub's* characteristics, the new ship also had other advantages. For one thing, it could lug more weight. It was a little faster. It was a little trimmer.

Even before Taylor could find a factory and before he set a price, orders began rolling in, orders from all corners of the country. Taylor's first cross-country trip in the plane was to Akron, Ohio, and then Alliance, where he found an excellent plant with an excellent flying field beside it. This was the old plant of the Alliance Aircraft Company, the ill-fated concern that built the Hess *Argo* biplane and the Hess *Warrior* motor only to be forced out of business when Aubrey Hess, designer and head of the company, was killed when his plane caught fire in the air while testing a new carburetor.

Then the orders rolled in. Taylor built two planes a week, then five, 10, 15 and 20—but the pace couldn't be maintained. Production now is about 10 to 12 a week, with plans under way for boosting it to 25 a week as a new addition to the plant is completed later.

All of which may give you an idea why C. Gilbert Taylor is such a figure in the aircraft industry.

END

Gliding

(*Continued from page* 66)

motorless flights. While engaged in this search, he visited Elmira and the first flights made from Harris Hill in late 1930 were so successful that arrangements were made for the first annual gliding and soaring meet. Since that time the annual contests have been held regularly at Harris Hill.

The activities of the meet this year were enlivened by a note of romance. President Richard duPont of the SSA intended to go to Wilmington in his glider to attend the wedding of his cousin, Ethel duPont, and Franklin D. Roosevelt, Jr. Weather conditions, however, would not permit the glider flight to Wilmington, so President duPont had to fly to the wedding in an airplane.

The field uses, in launching gliders, a winch which is operated by a car. The car-operated winch has proved successful at Elmira, where it has been in use for some time, although this launching device has generally proved more popular in European glider centers than in this country.

END

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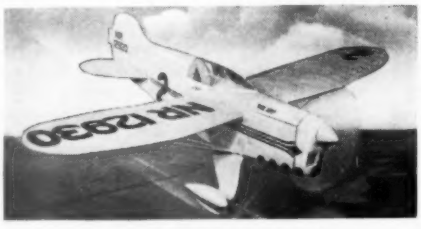

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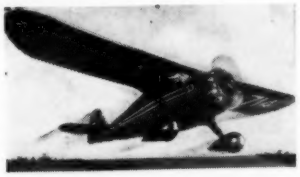

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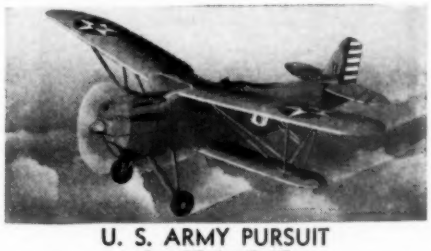

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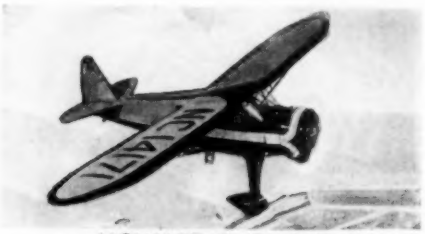

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I Soloed in 3½ Hours

(*Continued from page 32*)

position under your wheels. Norm squirms around and looks hard at me.

"Howzat?"

"Swell!" I had really enjoyed that.

"Okay, you try it . . ."

Oh oh! I hadn't expected that comeback. But I took over anyhow. Back on the stick gently. Ease the throttle back. Now she's stalling. A little right aileron. Opposite rudder. Over we go. I fight the controls against the spin and the *Cub* snaps into a dive like a scared bird. I'd yanked her out so hard we'd hardly gone through one turn. Over-control again, I climbed a bit to regain the lost altitude, then relaxed before trying it again. Then up easily, throttle back, wing down, rudder, and we're spinning. This time I let the controls flop loosely against my hands and feet. One turn, almost two and she comes out into her dive practically unaided! Golly, that was simple. They surely have worked the old dangers out of these modern airplanes. Spins used to be killers. Today, though, a ship is so well designed and built that she'll do a fine job of it all by herself.

Then landings. Norm told me my work in the air was quite satisfactory. That the only worry now was the landings. Which, after all, are the most important part of learning to fly. Norm played ultra-safe here. He made all the first landings, with me "following through" on the controls. He didn't let me take over as readily as he had up in the air. It's easy to get out of trouble in an airplane if you have plenty of altitude. But close to the ground, well, that's something else. He followed my motions like a hawk. Up and down. Time and again, we circled the field and headed into the runway. Finally he turned to me just after I had taken off and motioned that I was to make this landing myself.

Carefully, I did everything Norm had told me—and showed me. Gingerly I throttled back as the runway appeared just ahead and below the engine. I held the nose down a bit to keep plenty of control. I gave the airport's heavy wire fence plenty of room, then eased back gently as the runway came up at the wheels. I held my breath as we settled lower and lower. The left wing started to drop but I corrected that without paying any direct attention to it. The runway was skipping by just under the tires now, so I eased the stick all the way back. There was a slight thump, the wheels rumbled as we rolled down the runway and, well, I had done it!

After that it was a matter of "polishing up". Norm just sat in the ship watching me as I made take-offs and landings. I had become so wrapped up in getting those landings down just right that I paid little attention to the fact that, after one of them, Norm had casually climbed out of his seat.

"Okay, Paul, she's yours from now on!"

It's funny. There I was about to solo. I had thought I'd be scared to death. That's what you read about other pilots on their first solo. But I wasn't the least bit afraid. In fact, I was anxious to try it alone. So when Norm grinned and waved me down the runway, I shoved the throttle ahead just like I'd been doing that sort of thing for years.

But—*three and one-half hours before on that same morning I had never flown an airplane in my life!*

That solo flight was really a grand feeling. Without Norm's weight, the *Cub* scooted off the ground like a baby pursuit ship. Almost subconsciously I climbed, circled the field, approached, cut the gun and landed. That's actually all there was to it. It was just as easy as driving my car home *to lunch* a few minutes later.

Wow! I never enjoyed losing a bet so much in my life!

END

Sleeper Plane Adventure

(*Continued from page 20*)

A man who had left Chicago the afternoon before and traveled to New York by plane and back to Chicago again in the last 24 hours, confessed he left his pajamas in New Yark so he couldn't really sleep comfortably. About that time too, I decided to crawl in myself and with my overnight bag, disappeared behind the curtains.

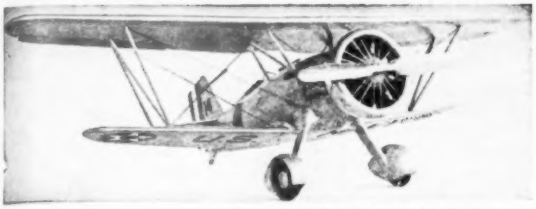
The stewardess twisted a little electric light bulb into the wall over my head and showed me how I could adjust the ventilators by pulling out one stopper, you could let in the whole out-of-door world, it seemed. A great rush of crisp cold air circulated round my head, making a loud whishing noise.

I quickly shut the air off a bit and snuggled down under the warm crimson blankets. The berth was roomy and comfortable and the mattresses very soft. There were coat hangers and a shelf for clothes. Outside a full moon swam in a cloudless sky. Stars twinkled merrily. By lifting my head from the pillow. I could see the lights of Fort Wayne, jewellike, far beneath.

I dozed off. The voice of the jewelry designer across the aisle, came to me indistinctly, still telling funny sleeping berth stories. The Californian leaned out of his berth directly across from mine, to wish me happy dreams. It was all very cozy.

It seemed but three minutes later that I was awakened by Miss Guest, gently shaking my foot under the blanket. "We're coming into Cleveland" she said. "Better get dressed." I dressed hastily, unbuckling first the wide safety belt which fastened me and the blankets in. Miss Guest found my shoes under the berth, I was still lacing one up, when we set down at Cleveland airport.

NEW CURTISS F11C4 NAVY PURSUIT



28" Span. Length 20½". Weight 4 oz. 1" Scale

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Construction Set complete, postpaid..... $4.50

Model ready built as shown.....$22.00

41" LOCKHEED ARMY SPEED VEGA

41" Span. Length 28". Weight 8 oz. 1" Scale

This new model, built very strong yet light in weight, is practically crashproof and will out-perform any large scale model built. Rises from ground in 10 feet and flies over 650 feet. Set contains all parts printed on balsa, ready cut pant cores, 4¼" turned motor front, 11" steel type carved paulownia wood propeller, 2½" balsa wheels, tail wheel, formed wire parts, 26" rubber, 3 oz. yellow dope, 2 oz. blue, ½ oz. black, 2 oz. glue, cement covering, full size scale drawing, and all parts. **$4.95**

Construction Set complete, postpaid.....

Model ready built as shown.....$25.00

NEW NORTHROP A-17 ARMY ATTACK

24" Span. Length 17". Weight 2¼ oz. ½" Scale
Color yellow and blue

A new scale model of one of the 125 Northrops ordered for the U. S. Army. Set contains all parts printed on balsa, turned motor front, 7" carved propeller, insignia, wheels, set of colored dope, glue, and all parts. **$2.50**

Const. set in labeled box, postpaid.....

Brown Jr. 1/5 H.P.

Long life motor with steel cylinder and piston for models of 5 to 8-foot span. ¾" bore, 1" stroke. Complete as shown in illustration, ready to run. **$21.50**

Price.....

LOCKHEED VEGA GAS MODEL

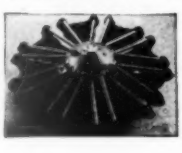
82" Span. Weight with motor 5 lbs.

Set contains formers, ribs, tips, pants, etc., all ready cut to shape, 8¾" turned motor front, 4½" rubber tired air wheels, silk covering, glue, and full sized drawing. This is a dry set without liquids. **$17.50**

Price set, f.o.b. N.Y.....

Model ready built.....$125.00

3¾" Celluloid Motor

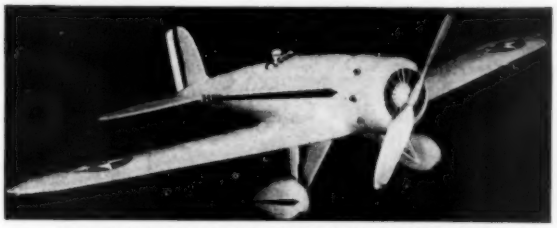


The last word in an exact scale Wright Cyclone 1200 H.P. G-100 with aluminum push rods, cylinder fins, and all details. **$1.00**

Price postpaid.....

Note: In issuing money orders, use Staten Island, N. Y., postoffice

NEW LOCKHEED P23A NAVY FIGHTER



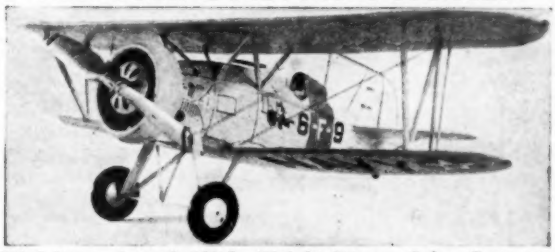
COMBINATION LAND AND SEA PLANE SET
32" Span. Length 20½". Weight 3½ oz. ¾" Scale

New 4-gun Navy fighter. Model will rise from land or water in few feet. Construction set contains fuselage and pontoon formers, wing ribs, tips, etc., printed on balsa, a 3⅝" turned cowl front, 2 instrument boards, colored insignia, lettering, windshields, 9" carved scale flying prop shown, 3 oz. silver paint, 1 oz. cement, ½ oz. black, 2 oz. glue, ready cut wheel pants, strong 2" aluminum wheels, 12 feet of rubber, and large 33"x44" drawing of land and sea plane. This is a sensational model and only one of its type in the world. **$2.95**

Construction Set in labeled gift box, postpaid.....

Model ready built as shown.....$20.00

NEW BOEING F4B4 NAVY FIGHTER

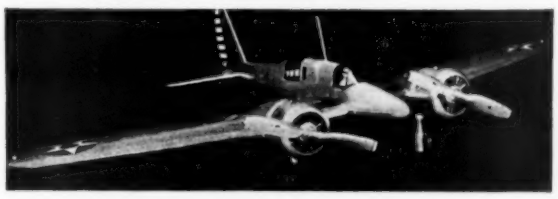


22½" Span. Length 14½". Weight 2⅓ oz. Color, Grey, etc.

This is the finest equipped Boeing, F4B4 model in the world. New improved model exclusively equipped with new 3¼" special aluminum streamline tapered cowl ring, 9 cylinder celluloid motor with aluminum ventilator front, 8" carved varnished steel type propeller, printed out balsa wood parts, 2 oz. grey dope, ⅓ oz. yellow, ⅓ oz. red, paper cement, glue, formed wire parts, celluloid wheels, tail wheel, U. S. Navy lettering, colored insignia, and ¾" scale drawing. **Construction Set complete, postpaid..... $2.95**

Model ready built as shown.....$20.00

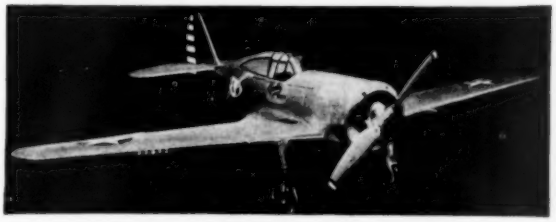
NEW CURTISS Y1A-18 ARMY ATTACK



38" Span. Length 26". Color yellow and blue

This new twin motor model has lots of reserve power on its two 8" props and flies very well. Set as all parts printed on balsa, colored paints, glue, etc., full size scale drawing, two 3" turned balsa motor fronts, wheels, two 8" steel type carved props, etc. **Const. set, postpaid..... $4.50**

NEW CURTISS ARMY HAWK 75 or P36



37" Span. Length 27". Weight 5½ oz. 1" Scale

The U. S. Army has ordered 210 of this latest pursuit ship. Const. set has all parts printed on balsa, 10" steel type carved prop, 4" turned balsa motor front, insignia, 3 oz. silver dope, 2 oz. glue, etc., and full size scale drawing. A big powerful-looking model. **Set postpaid..... $3.25**

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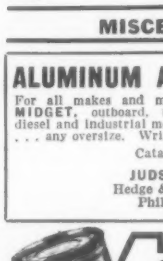

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FOR SALE—Converted Henderson Motor, including 2 props, $30. R. G. Eckert, 660 Jefferson St., Burlington, Wis.

WANTED—2 left wings C 3-5 Spartan, Speed ring J6-5, G. Graffunder, Gaylord, Minn.

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Questions and Answers

(*Continued from page 56*)

type of motor—possibly a rocket type for normal altitude flight.

When we consider that the complete weight of the Italian record breaking Macchi plane was less than two pounds per horsepower, and that it is a real achievement to build a commercial aviation engine weighing alone one pound per horsepower, then we see the prohibition that is placed upon much higher speeds with the present type of motive power.

As a second obstacle to higher speeds is the difficulty of dissipating the waste heat from the engines, for in the Macchi plane, all of the ship (including the pontoons) was used as one huge radiator, and even with all this cooling surface, it was possible to fly only a short distance without overheating.

* * *

D. A. F., Dixon, Ill. Does a magneto give a much hotter spark than a battery coil? Is this the reason that it is used on airplane engines instead of the battery systems used on automobiles?

ANSWER. Either the magneto or battery system can provide a hot spark of sufficient intensity—but that is not the reason. In the first place, the magneto is a compact self-contained unit that is not dependent upon heavy unreliable batteries. Even though the plane is equipped with batteries for radio and lighting, the magneto is still desirable as a source of ignition. As you probably know from experience with automobiles, batteries are not very reliable and go out of service without much warning. Magnetos, on the other hand, seldom fail if properly cared for and weigh less than batteries.

* * *

W. R. T., Dundee, Ill. I am wondering just what interest the S. A. E. or Society of Automotive Engineers finds in aviation. Why don't they stick to their automobile problems?

ANSWER. You, and many others, have a mistaken idea of the scope of the S. A. E., possibly for the reason that the word automotive is construed as meaning automobile.

When first organized, the group was known as the Society of Automobile Engineers, and its function was purely automobile engineering. However, as time went on, the automobile type engine was being adopted on many other types of vehicles as well as automobiles, such as motorcycles, motor-boats, tractors, airplanes, etc., hence the attention of the membership was called to self-propelled vehicles other than automobiles.

Therefore, just before the World War, the members decided to give the Society a more comprehensive name that would cover all types of vehicles using gasoline engines. This all embracing name was the word "Automotive," which means "self-propelled," and it was interjected into the name of the society in place of the word "Automobile."

END

Canadian Airline

(*Continued from page 57*)

disposed of the balance of the $5,000,000 capital stock to other private aviation interests. The government has three men on the board of directors, the Canadian National Railways three, and the private interest three. The government supplies for a deficit for the first two years, and gives the corporation the use of landing fields and a weather service free for that period, after which it is expected the airway will pay for itself.

With the early operation of trans-Atlantic air service from Great Britain it was deemed necessary that Canada have a transcontinental airway to carry Empire air mail between the Orient and Great Britain. So during the early part of the depression emergency airfields were built with unemployed labor and with great physical difficulty across the Dominion for an eventual airway. Sparsely settled virgin bush regions in northern Ontario and the Rocky Mountains made the task more difficult than the fields across the prairies. Now all fields are nearly ready, nearly all are equipped with weather reporting equipment, radio stations, radio beam stations, and telephone lines. With the perfection of the personnel in operating the route, test flights are now being made, the service is to begin this autumn. Phillip G. Johnson, formerly president of an American airline, has been retained by the Canadian government as vice-president of operations.

The Canadian airway starts on the Atlantic coast at Halifax, crosses to St. John, crosses the top of the state of Maine to Montreal, and continues via Ottawa to Emsdale, where the line from Toronto joins to continue via Cobalt, Cochrane, Hearst, Sioux Lookout to Winnipeg. This route over practically uninhabited northern Ontario north of Lake Superior was chosen for its fog freedom in winter time. From Winnipeg via Regina, Lethbridge, through the Crow's Nest Pass in the Rocky Mountains to Vancouver. Connections with United States lines are made at Vancouver, Winnipeg, Toronto, Montreal and Halifax. Connections with the Canadian northland are made at Lethbridge, Winnipeg, Sioux Lookout, Toronto and Montreal.

Holland

(*Continued from page 30*)

A Bristol *Mercury* engine of 830 h.p. is normally mounted. Top speed is rated at 229 m.p.h. at 15,500 feet and 223 m.p.h. at 19,600 feet. Absolute ceiling is 31,160 feet and range is 683 miles.

In addition to the Fokker and Koolhoven firms, the Aviolanda company has made various models of foreign designed planes for local use. Rights to build the Dornier-Wal were acquired, as well as license rights for the Curtiss *Hawk I.*

END

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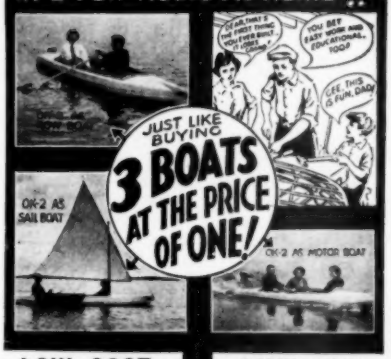

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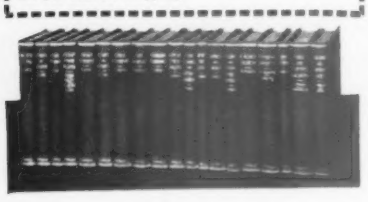

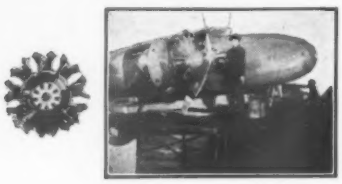

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